# VERIFICATION AND BALANCE IN SCIENCE NEWS: HOW THE NEW ZEALAND MASS MEDIA REPORT SCIENTIFIC CLAIMS

A thesis

submitted in partial fulfilment

of the requirements for the Degree

of

Doctor of Philosophy

By

Laura A. Sessions

University of Canterbury

2003

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# ABSTRACT


Accuracy and balance are fundamental principles of journalism worldwide. The main way that journalists ensure accuracy is by verifying the information in their stories against an independent account. Most journalists who report science must rely on scientific experts to verify the validity of claims they report. However, previous studies have found that science stories commonly contain only one source.

Journalists typically maintain balance by fairly presenting opposing views. Previous studies show that when journalists present conflicting claims, they tend to balance the different opinions equally, regardless of the empirical evidence on which those claims are based.

This thesis investigated verification and balance in New Zealand mass media science news, using a national survey and in-depth interviews with New Zealand journalists, and a content analysis of newspaper, radio and television coverage. The content analysis showed that verification was uncommon in New Zealand science news, and only 32% of science claim stories cited more than one source. Furthermore, 23% of stories were five sentences or shorter, and the majority of stories (65%) were drawn from overseas news organisations and wire services. When opposing views were presented, journalists tended to use a balancing strategy without any interpretation of which view was supported by the weight of evidence.

The interviews indicated that these practices are partly influenced by time constraints. New Zealand almost completely lacks specialised science reporters, and only five of the surveyed journalists had a dedicated science round. Most surveyed journalists spent less than 20 hours per month reporting science, and few had formal training in science. However, journalists also said that the normative dimensions of being a journalist were important. In particular, journalists tended to value balance and fairness over ensuring the validity of claims they report. Exploratory focus groups suggested that audiences may also strongly value a balanced and unbiased approach to science reporting.

# CHAPTER 1:

# INTRODUCTION

## 1.1. In the beginning there was Lyprinol...

On Friday, 30 July 1999, TVNZ's ONE News went to air with an exclusive story on a major medical breakthrough. Lyprinol, an extract produced from green-lipped mussels, had killed cancer cells in an Australian laboratory test. Holmes, the most popular current affairs show in New Zealand, followed up on the news story with an even more conclusive headline: "Tonight on Holmes: green-lipped mussels – will they cure cancer? Australian researchers say there is a 90% chance they will. Green-lipped mussels, grown only in this country, have the potential to save millions of lives worldwide. Are we on the brink of one of the biggest-ever medical breakthroughs?"

The following day (Saturday) the *New Zealand Herald* followed TVNZ's lead with yet another story of the "breakthrough". Although it included cautionary notes from other parties in a separate article, its lead story suggested Lyprinol was indeed a miracle cancer cure. The opening read: "An Australian researcher is 90% sure that an extract derived from New Zealand's green-lipped mussel will provide the key to the holy grail of medical science." This scientist, Dr. Hendry Betts, was quoted as saying, "If I was diagnosed with cancer, I would take as much Lyprinol as I could hold down."

The following Monday, Lyprinol was sold for the first time in pharmacies throughout the country and New Zealanders promptly bought $2 million worth of the pills (Comrie 2000). Hundreds of people abandoned their conventional treatments, opting for the new miracle cure. But by that evening, Lyprinol was withdrawn by the distributor under pressure from the Ministry of Health. Given that no clinical trials had been conducted yet, the Ministry judged that the media hype far outstripped the evidence from research.

Complaints laid by the Ministry of Health with the Broadcasting Standards Authority were upheld, finding that the ONE News coverage was "inaccurate, lacked objectivity and distorted the research" and that the introduction to the Holmes programme also "exaggerated the status of research into the product and breached standards of accuracy." In 2001, Lyprinol (NZ), the company that sold Lyprinol, and Pacific Pharmaceuticals, the distributor, were each fined $15,000 for breaches of the Medicines Act. In March 2002, Pharmalink, the Queensland-based company that had backed the Lyprinol cancer studies, finally stopped funding the research.

## 1.2. The impetus for this research

At the time this debacle occurred, I had just finished my M.Sc. and as a newly-fledged scientist, I remember wondering how things could have gone so wrong. It seemed like a classic case of media failure to "check the facts" (a view many in the media seemed to agree with). It became like a magnet that attracted other examples of bad science reporting to my attention. Other scientists in my department told me stories of all the media bloopers and blunders they had experienced, and I made mental notes on the errors in every piece of science news I encountered.

All of these anecdotes left me to speculate about why the media seemed so bad at reporting science and whether there was any hope for improvement. They were naïve questions given my lack of understanding of journalists' day-to-day work, the normative dimensions of their profession, or the ways that news organisations operate. Ironically, though, many scientists and science organisations were asking – and continue to ask – the same questions.

More specifically, I became interested in two media practices. First, in cases like Lyprinol, why did journalists often seem to skip an independent verification of the scientific facts? A simple cross-check with an independent scientist seemed like an easy and fundamental thing to have done in the case of Lyprinol, and yet no such verification was apparently attempted by the largest television network and the largest newspaper in the country.

Second, when some attempt was made to get different scientific views, why did journalists often treat all opinions as equally valid, no matter how much evidence they had to support their claim? Dunwoody (1999) calls this a "balancing strategy", where the journalist simply reports two or more opposing opinions and leaves it up to the audience to decide who is right. The problem with this approach is that it does not encourage journalists to critically assess the validity of competing scientific claims. As a result, journalists just present alterative views with no analysis of the ideological basis, vested interests or empirical evidence on which those claims are based (Durham 1998).

For example, just six months after the Lyprinol fiasco, a climate conference at The Hague and then a meeting of the Intergovernmental Panel on Climate Change (IPCC) in Auckland drew the New Zealand media's attention to the issue of climate change. By this stage, there was a scientific consensus that average global temperatures had increased over the past 50 years, that this change was largely due to an increase in greenhouse gases and that the changes were at least partly anthropogenic (Wilson 2002). However, rather than focusing on the IPCC consensus, the media focused on the disagreements between IPCC scientists and a few contrary mavericks. Headlines read "Blowing hot and cold on climate (*Evening Post*, February 16, 2000, p. 26), "Climate scientists now not so sure" (*Evening Post*, December 13, 2000, p. 5), "NZ scientist says global warming a misreading" (*The Press*, November 29, 2000, p. 12) and "Global warming overrated, says visiting climate expert" (*Evening Post*, February 14, 2000, p.13). These articles gave no assessment of how likely to competing claims were to be true, or which claim was supported by the weight of evidence.

These two questions about the handling of verification and opposing viewpoints eventually became the impetus for this research. My goals were: first, to determine how representative these anecdotes were of overall science coverage (perhaps in fact I had only stumbled across a few aberrant cases); second, if they were representative, to find out why journalists acted in these ways; and third, to apply this information to suggest improvements for science reporting in New Zealand.

## 1.3. Media constraints: Beyond resources to the social production of news

When I began this research, it seemed plausible that all of the problems in science communication in New Zealand could essentially be traced back to resource constraints. In a country of four million people, news organizations will necessarily be small, with limited resources and staff. Speciality reporting is perhaps a luxury in such an environment. Moreover, New Zealand has one of the most competitive news environments in the world with little public broadcasting. This makes it difficult for science to compete against other news topics for space and time, since science does not usually top the news list in entertainment value, and its complexity often means that significant time and resources must be devoted to produce an accurate science story.

However, although resources are clearly important constraints on science reporting, I slowly came to realise that a more complex set of forces shape science news – just as they shape *all* news. These routines and professional norms of journalism, such as objectivity and balance, are deeply embedded in the way that journalists think about and write about news. They are radically different from the values and norms of science and understanding them may help explain why practices objectionable to scientists are second nature to journalists. Much of the literature on science communication discusses this "culture clash" between scientists and journalists.

I not only studied these cultural differences between journalism and science – I experienced them almost every day that I worked on this project. I felt it when I negotiated meetings with my supervisors (a scientist and a journalist); when I talked to journalists and scientists about my research; and, at the most personal level, when another writer reported research I was involved with and when I attempted a bit of science writing of my own. I have experienced the frustration of trying to reach sources that never ring you back, and also the embarrassment when a journalist misinterprets your work.

It is important to note that some scientists have also begun to appreciate the value in understanding journalistic norms and routines, and they may use this knowledge to manipulate the media in order to promote science generally or their own specific agenda

(Dunwoody 1999). However, such knowledge can also be used for other purposes; most importantly, to encourage more in-depth, analytical coverage that might help audiences make well-informed decisions. Ultimately, I believe that this type of coverage will result from more independent verification and a 'weight of evidence' approach to controversial scientific issues. They are not promotional strategies for science, because they encourage journalists to think about the relative evidence for each scientific claim. Thus, scientists might support these strategies in theory, but individual scientists may be critical when their own research is challenged.

## 1.4. Assumptions of this research

In investigating these particular questions, I started with several assumptions. Most importantly, I assumed that independent verification and a weight of evidence approach are desirable, and that science coverage could be improved by encouraging such practices. Although numerous communications scholars concur with these assumptions (e.g. Dearing 1995; Nelkin 1995; Dunwoody 1999; Stocking 1999), not all journalists would agree.

In addition, although I have gained a more complex understanding of how the media operates over the past three years, I am still a scientist at heart and a scientific worldview colours this thesis. Perhaps most importantly for this study, I continue to reject a completely relativistic standpoint. I do believe there is an 'objective' truth out there, although we may never perfectly capture it with our imperfect modes of language and collection. My continued belief in an objective reality has had a substantial influence on this text, and this study would clearly be very different otherwise.

## 1.5. Definitions

Throughout this thesis, I use the term 'science' in a broad sense, as most science communication scholars have, to include "the biological, life and physical sciences but also the social and behavioural sciences and such applied fields as medicine, environmental sciences, technology and engineering" (Friedman et al. 1986).

The term 'mass media' is typically used to refer to any form of communication that reaches large numbers of people, but here it is used primarily to refer to newspapers, television and radio. Other outlets such as books, magazines, newsletters and electronic media are not discussed in any detail here.

## 1.6. Thesis outline

Chapter 2 begins with a literature review that describes the 'public understanding of science' movement, both here in New Zealand and overseas, and discusses why the media are important in this endeavour. I also introduce media theory on the social production of news and discuss the various hierarchical forces that may shape science content in the media.

Chapter 3 focuses on the two specific media practices that were the focus of this study: verification and the presentation of scientific controversy using the 'balancing' versus the 'weight of evidence' strategy. I illustrate how a lack of verification and the reliance on the balancing strategy may be problematic in science reporting using a case study of media coverage of a scientific claim about the illegal importation of genetically modified corn seeds.

The following three chapters (4, 5 and 6) contain pieces of research that together describe the state of science coverage in the New Zealand media and attempt to understand some of the factors that influence this coverage. Chapter 4 begins with a survey of New Zealand journalists to identify who reports science here and to explore some of their attitudes towards reporting science, and more specifically towards verification and the balancing and weight of evidence strategies. These attitudes are then compared to actual media coverage in a content analysis of science news (Chapter 5), and explored in more detail in in-depth interviews with journalists who spend the most time reporting science in New Zealand (Chapter 6).

Chapter 7 then changes the focus from media content to media effects, with an exploratory study of how audiences might respond to different journalistic strategies for presenting scientific controversy. The final chapter (Chapter 8) brings all of these results together in a discussion of the state of science reporting in New Zealand and the factors that have led coverage to be the way it is, as well as looking forward to ways that science reporting here could be improved.

## 1.7. Research goals

The goals of this thesis were:

- To understand the organizational structure of science reporting in New Zealand, including who reports science and what organizational constraints they work under.

- To characterise science news in New Zealand (e.g. how much coverage is produced, by whom and what topics are covered) and to determine what factors might influence these patterns.

- To determine how often journalists independently verify scientific claims and to understand how this might affect science news content as well as why journalists do or do not conduct such validity checks.

- To determine how journalists deal with conflicting scientific claims and to understand how these strategies affect science news content as well as why journalists prefer certain strategies over others.

- To explore how audiences interpret different strategies for reporting scientific controversy.

# CHAPTER 2:

# SCIENCE COMMUNICATION AND THE SOCIAL PRODUCTION OF NEWS: A LITERATURE REVIEW

## 2.1. The public understanding of science

### 2.1.1. Why is the public understanding of science important?

Science communication is a rapidly growing field of interest among academics, scientists, government agencies and private industries internationally. It is what Gregory and Miller (1998) have called a "public understanding of science industry", spawning two professional journals and numerous academic programmes and departments in the United States, Britain, Europe and Australia over the past 20 years. Why is it so important for the public to understand science? Ziman (1992) has suggested that three models have been used to explain its importance.

#### *2.1.1.1. The deficiency model: Benefits for science and the state*

The *deficiency model* states that scientists depend on the public for funding and support, and it assumes that reducing ignorance of science may help to increase this support (see Hartz and Chappell 1997). Associated with this belief that public scientific illiteracy leads to a lack of support for science is the related suggestion that illiteracy is also connected to a growing anti-science or pseudoscience sentiment (renewed opposition to evolution and anti-biotechnology movements; Angell 1996).

Thomas and Durant (1987) argue that not only is public understanding of science important to science institutions but also to nations. Technological research and development can revolutionise industry and product development, and informed consumers more readily appreciate new technologies and services (Gregory and Miller 1998). In addition, the job market increasingly demands labour with scientific and technical skills (Gregory and Miller 1998). Hartz and Chappell (1997) also claim that science and technology yield enormous national power and influence in international politics.

The knowledge deficit model has been heavily criticised because of its conception of the public as passive recipients of information. It does not acknowledge that individuals will interpret and contextualise information based on their own experiences and prior knowledge, nor does it acknowledge that individuals also have needs for specific information that is relevant to their own lives (Gregory and Miller 1998). Furthermore, this model assumes that scientific communication should be positive and assert the benefits and achievements of science but not the risks and problems. On the contrary, scholars have called for the press to become increasingly critical of science as they are of other fields (e.g. Nelkin 1995).

The knowledge deficit approach also assumes that people respond negatively to science and technology because they do not understand it, and thus education will reduce or eliminate this ignorance and resistance. However, empirical studies have mostly failed to show this link between scientific knowledge and support for science. In fact, Tanaka et al. (2000) found that highly educated respondents in New Zealand were the most critical of science. Similarly, Mazur (1981) found that media coverage of a scientific controversy increased public opposition to the technology even when the coverage was not negative. Evans and Durant (1995) found that knowledgeable members of the British public were more "favourably disposed" towards science in general, but they were less supportive of morally contentious issues such as human embryology.

Priest (1994; 1999; 2001) also points out that the knowledge deficit model ignores that risk assessments are partly about values and that dissent may also be a response to institutions with established images and reputations. Her studies show that judgements of risk include a range of considerations including ethics, the environment, regulation, communication and socio-economics. For example, her study of public attitudes to biotechnology in the United States in 2000 found that trust in social institutions was the strongest predictor of support for biotechnology, while level of genetic knowledge was only a weak predictor (Priest 2001).

*2.1.1.2. The rational choice model and a scientifically literate public*

The second model, the *rational choice model*, suggests that people need to know some science to be good citizens and to live in a culture largely shaped by science (Ziman 1992). In an "information society", possession of information is power and the group of citizens that do not understand science may be in danger of becoming a "scientific underclass" who are unable to understand and function in modern society (Gregory and Miller 1998). In a famous 1959 lecture, C. P. Snow worried about a similar divide between scientists and other intellectuals, a cultural divide in this case that he believed would cause most leaders to fail to recognise the importance of science and that would lead to a growing divide between the rich and the poor (see Snow 1993).

Science has a myriad of implications for public policy (e.g. the impact of new medical techniques, biotechnology and climate change; Nelkin 1995); economic and business news (e.g. the development of new products and technology and their influence on industry); and social issues (e.g. stories related to crime and violence; Burkett 1973). This model assumes that with more science knowledge, the public could make better judgements on technical issues at both the community level (e.g. solid waste disposal, pesticides, social welfare, species conservation, power plants and food and technology advances) and the individual level (e.g. choice of medicines, surgery, nutrition, recycling and environmental risks).

Problems with the rational choice model include how to decide what information people need to make informed decisions, who should decide on the information content and who should provide this information (Ziman 1992). In other words, what information does an individual need to possess to be scientifically literate? Durant (1993) argues that "understanding" does not equate with "knowledge" because an accumulation of facts does not imply an understanding of their relevance, applicability or significance. Others have suggested that an understanding of the scientific process, such as hypothesis testing, would help the public understand science (Nelkin 1995). However, critics argue that real science does not happen according to the scientific method (Bauer 1994) and that scientists and pseudoscientists all may appear to use scientific methods yet reach very different conclusions (Durant 1993).

Durant (1993) suggests that understanding how science "really works" may be the best way to increase the public understanding of science. He suggests that people should understand science as an institution, such as research protocols, peer review, and how new science is handled within the scientific community. However, Gregory and Miller (1998) point out that people still need to have considerable scientific knowledge to understand scientific processes. A fourth option is that people should actually understand more about journalistic constraints and norms, for these may offer significant insights into "the science behind the headlines" (Gregory and Miller 1998, p. 131).

Other scholars have argued that attempts to create a scientifically literate public are futile and that it would be more effective to focus on a small proportion of the population that is already "attentive" to science (Miller 1986; Shamos 1995). However, this focus on only one sector of society could just reinforce the gap between the knowledge 'haves' and 'have-nots'. Moreover, this approach is not consistent with the belief that a democratic society can only operate when the majority of the public is adequately informed.

#### *2.1.1.3. The context model: An audience-centred approach*

Finally, the *context model* suggests that people want to know certain things from science given the circumstances of their individual lives (Ziman 1992). Evidence suggests that when people are affected by scientific matters (e.g. medical problems), they become very knowledgeable about that subject (Gregory and Miller 1998). This approach is audience-centred, and it means that people need different scientific information depending on their individual circumstances. For example, people may get information from different sources (e.g. *Scientific American* or the local newspaper) that use different formats and languages (Miller 1986). This model also stresses that "people do not passively absorb everything that is beamed from their television set. Instead they interpret and contextualise" (Miller 1999, p. 218).

### 2.1.2. The role of the mass media in science communication

Given the above reasons for the importance of public scientific understanding, what evidence is there that the mass media may provide an important source of scientific information? Numerous studies have shown that the media are the primary source of scientific information for the public after they leave school (Detjen 1995; Nelkin 1995). In some cases, the media may even be the sole source of information, as Bell (1994b) found for climate change in New Zealand. Thus, Conrad (1999, p 285) says, "Science journalists become gatekeepers for the infusion of scientific information into the public sphere."

The public also *want* more science coverage (Crane 1992; Nelkin 1995; Hartz and Chappell 1997). A 1993 survey in the United States found that the public think science is as important as politics, crime and business (Detjen 1995). A similar study in Britain also found that people were more interested in medical and scientific discoveries and new technologies than in sport, film and politics (Durant and Evans 1989; Durant et al. 1989). A recent study in New Zealand showed that 73% of respondents enjoyed finding out about new ideas in science, and 66% acknowledged the importance of knowing about science in their daily lives (Hipkins et al. 2002). This desire for more science news is important because Miller (1986, p. 56) found that the single "most important factor affecting someone's receptivity to scientific information appears to be interest."

The effect of press coverage on public attitudes is difficult to assess for many reasons (Gregory and Miller 1998), but there is evidence that the media can influence people's beliefs and behaviour in some cases (Miller 1999). For example, coverage of the ozone controversy led people to buy fewer aerosol sprays; reports on cholesterol caused people to change their food-buying habits; and reports on birth control risks made people reduce their use of contraceptives (Nelkin 1995). In New Zealand, news about a new "cancer cure" called Lyprinol caused New Zealanders to go out and buy $2 million worth of the pills in the few days following the report (Comrie 2000).

However, news coverage does not always translate into public behavioural change, because the acceptance of scientific ideas may also depend on whether there are divisions of opinion among scientists, whether alternative explanations are available, and the experiences and knowledge of individuals (Miller 1999). Much evidence suggests that people only acquire scientific information that they need for their own particular circumstances (Levy-Leblond 1992). In addition, people use the information only when it corresponds to their prior inclinations (Nelkin 1995), and they are unlikely to transfer this knowledge to other circumstances (Gregory and Miller 1998).

The relative importance of the media versus primary groups (e.g. family) and personal relationships in influencing public opinion has been hotly debated since the 1930s. The current model suggests that the influence of the media will depend on the social context and on each individual's own unique educational background, reference group, experiences, interests and prior beliefs (Klapper 1960; Ziman 1992). Demographic factors such as class, gender, ethnicity, occupation, and age can all influence the frames within which people interpret the news (Miller 1999). Thus, the media have influence at both the individual and societal level.

At the individual level, the media cannot be seen as a one-way force affecting public understanding, but rather the media's messages interact with individuals' experiences and biases and also cultural values and social factors (Halloran 1998; Miller 1999). Thus, different individuals will approach stories with varying "frames". A frame is "a persistent pattern of cognition, interpretation and presentation, of selection, emphasis, and exclusion" (Gitlin 1980, p. 7), and it will cause individuals to cull different meanings from stories or to respond differently to the same media account (Corner and Richardson 1993). For example, alternative information from trusted non-media sources may strongly influence perceptions of risk (Miller 1999). Wynne (1999, p. 7) explains that "the public understanding of science represents an *interactive* process between lay people and technical experts rather than a narrowly didactic or one-way transmission of information packages." Mass communication research has thus moved from studying the media in isolation to a more holistic understanding of the interactions between the news producers, the news itself and the audience.

At the societal level, the media's most important role is to create "climates of opinion" (Halloran 1998) or to set the public "agenda" (Goodell 1987). By selecting from a vast supply of information, the media decide which issues deserve public attention, usually by amplifying issues that have already attracted attention and occasionally by generating interest in new issues (Goodell 1987). This agenda-setting role is probably more important than the media's effect on public attitudes or opinions (Dearing and Rogers 1996).

Press coverage may also influence financial support for scientific research in general and create support for certain scientific priorities over others (see Ziman's 1992 deficiency model above; Nelkin 1995; Hartz and Chappell 1997; Miller 1999). For example, Nelkin (1995) believes that news coverage of environmental problems has encouraged the growth of the fields of ecology and toxicology.

On the other hand, media coverage may actually tend to provoke public opposition to technology (Mazur 1981; 1984). For example, Mazur (1981) found that the quantity of media coverage of a controversy had more influence on public opinion than its quality. An increase in coverage of the controversy led to an increase in public opposition, regardless of how positive or negative the coverage was. Similarly, Durant and Evans (1989) found that while the British were less knowledgeable about science issues than Americans, they were also more supportive of increased government spending on the sciences.

In many cases, the coverage of science may be so small that it cannot achieve agenda-setting (Atwater et al. 1985; Weigold 2001). However, although this is not well-understood, media coverage can also have short-term effects on the audience's opinions and attitudes, which can translate into policy changes. The media influence policy-making both directly (by targeting an audience of decision makers; Protess et al. 1991) and indirectly (by shaping public opinion; Miller 1999). Metcalfe and Gascoigne (1995) suggest that almost all major science and technology policy initiatives in Australia during the early 1990s followed media campaigns by scientists to stop science funding cuts.

Perhaps more importantly, the media may also produce "cultivation" effects, which shape public views of scientific institutions, the way that science works and who should be trusted (Priest 2001). Priest (2001) suggests that individual news stories cannot generate support or opposition to particular forms of science and technology, but over time, media coverage as a whole can influence public opinion by suggesting which sources and institutions are trustworthy. A public opinion survey in the United States in 2000 found that public trust in social institutions was the most important predictor of support for biotechnology (Priest 2001).

## 2.2. A brief history of science journalism

Media coverage of science and technology during the twentieth century has fluctuated according to cyclical trends that reflect the dominant political and societal values of each time period. The media first began to cover scientific issues regularly during World War I, because of the large-scale effects of new technologies (e.g. tear gas and TNT) and the abundance of new medical developments. In 1921, E.W. Scripps established the first science news service in the world, which sold science news to hundreds of newspapers and other publications throughout the United States (Friedman et al. 1986).

A small number of science journalists began working for large publications in the United States and Britain after World War I, and in 1934, the first professional organisation for science journalists was established in the United States: the National Association of Science Writers (NASW). However, its membership remained small (Friedman et al. 1986), and science popularisation was still mostly left to scientists.

It was not until World War II that science as a journalistic pursuit really expanded. WWII generated numerous new technologies – some as frightening as the atomic bomb – and as the public began to question these new technologies, the American government began to fund research into how public support for science and technology might be improved. Journalists increasingly took over the communication of science, with scientists left as sources once removed from the public (Gregory and Miller 1998).

After World War II, other events (such as the beginning of the U.S.-Russian "space race") continued to attract the media's attention to science. By 1960, the NASW membership had swollen to ten times its membership in 1940 (Friedman et al. 1986).

This enthusiasm for science continued through the 1960s, when a period of scientific and technological "breakthroughs" (e.g. sending a man to the moon, discoveries in the physical sciences) were covered by the press with "elation" (Nelkin 1995).

However, during the late 1960s and 1970s, the media became more critical of the potential consequences of science. There was increasing public concern for the environmental and social risks of science and technology, and thus journalists began to focus not just on science's achievements, but also on its social, political and economic context (Friedman et al. 1986). The first science-trained journalists emerged at this time, and as Gregory and Miller (1998) state, science journalists began to see themselves "less as missionaries for science and more as critics and commentators – like their colleagues on other beats."

At this stage, scientists were almost entirely pushed from popularisation and withdrew into their own insular scientific communities. This withdrawal in turn caused a resurgence of popularisation and discussions about the role of science in society from the 1980s onward. From 1977 – 1984, at least 15 magazines, 18 newspaper sections and 17 television shows on popular science emerged in the United States alone (Lewenstein 1987). The 1980s also saw the press expressing renewed enthusiasm for technological developments in fields such as computers and biotechnology, but this was balanced with increased public scepticism and fear of the risks associated with the new developments. Environmental reporting also grew significantly as a distinct discipline during the 1980s and the early 1990s amidst a growing awareness of environmental issues and risks (Detjen 1995).

For their part, scientists were increasingly urged to give a higher priority to popularising their work in the 1980s because of a decrease in funding for science (Dunwoody and Ryan 1985; McCall 1988). However, this does not seem to have arisen from a change in scientific culture since the scientific community still did not reward scientists for popularising their work (Gregory and Miller 1998). As a result, many scientific societies and organisations took on the public understanding of science cause but most scientists still rated it low on their list of priorities (Friedman et al. 1986).

One of the most significant changes in science reporting during the 1990s was the mode of scientific communication. Previously, science news had come primarily from the major peer reviewed journals and conference presentations. However, information technology, the new importance of science to business, competition for grants and flaws in the peer review system began to change the way that science news is created (Anton and McCourt 1995). The World Wide Web now makes it possible for scientists to communicate directly with the public, or at least with the sector of the public that are affluent enough to afford computers and internet access (Norris 2002). The Web may also enable reporters to quickly access a wide range of scientific sources and information, which might in turn encourage a greater diversity of news sources. However, the Web also poses substantial problems for journalists, such as how to identify the credibility of information received.

By the 1990s, science journalism was well-established as a profession. In the United States alone, there were 600-800 science and medical reporters (Klaidman 1991) and more than 50 degree courses on science writing (Dunwoody et al. 1999). Australia alone had about 140 science journalists and a handful of science writing courses by the mid-nineties (Metcalfe and Gascoigne 1995).

However, despite the burgeoning field of scientific communication overseas, interest in science journalism in New Zealand is only now beginning to grow. In fact, I am aware of only one published study on science reporting in New Zealand. Bell's (1994b) research on coverage of climate change suggests that the media are a primary source of scientific information for the New Zealand public and that science stories in this country contain a similar number and type of inaccuracies as stories in the United States and Europe. A majority of scientists (84%) believed that stories that they contributed to were accurate or only slightly inaccurate, but they were less satisfied with the accuracy of science coverage in general, suggesting that scientists here, as overseas (e.g. see Tichenor et al. 1970), hold a negative stereotype toward the media. A majority of the public (74%) believed that science reporting was accurate or only slightly inaccurate (Bell 1994b). While suggestive, these results are based only on climate change stories and may or may not indicate trends in overall science journalism in New Zealand.

## 2.3. The science – journalism divide

Much of the literature on science communication over the past 15 years has focused on the cultural, professional and personal differences between journalists and scientists. Science journalism reflects characteristics of both science and journalism and therefore must struggle to bridge the gap between these two disparate professions. Among the most important differences between science and journalism are the following:

- Science is slow, conservative and precise while journalism is dramatic, fast, short and often imprecise (Hartz and Chappell 1997). Science is thus incremental, a gradual process where experiments must be replicated and peer reviewed before they are published. Journalists work on a short time-frame and cover current events (Nelkin 1995). For them, established ideas are "old news".
- Science must be proven "beyond a reasonable doubt", is falsifiable and may be statistically tested. Journalism on the other hand is based on a "preponderance of evidence" (Hartz and Chappell 1997).
- Scientists and journalists use different languages and different writing styles. Scientific language is guarded and qualified but also uses more jargon to convey the complexities of the issue. Journalists frequently use metaphors as a tool and are concerned with making their writing readable, simple and understandable to the general public (Anton and McCourt 1995; Nelkin 1995).
- Scientists are judged primarily by – and write for – their peers, so they use specialised vocabulary and back their argument with great detail. They emphasise precision and information density over readability. Journalists are judged by and write for the public, so they place value on clarity, simplicity and interest (McCall 1988).
- Scientists and journalists also hold differing views on the role of the press. Many scientists say that its purpose should be to promote science and its understanding by educating the public, but journalists generally see their goals as entertainment and information (Hansen 1994; Nelkin 1995; Reed 2001).

These differences make it difficult for journalists and scientists to communicate, and they have lead to misunderstandings and criticisms from both sides. Some authors have suggested that specialist science writers may help to overcome some of these barriers, since they have a foot in each camp (e.g. Anton and McCourt 1995). However, other authors (as well as editors) have expressed their concern for science reporters who become "too close" to their sources and fail to be as critical as their colleagues on other beats (Nelkin 1995).

For their part, journalists criticise scientists for their inability to communicate effectively with reporters and the public (McCall 1988). Scientists are accused of using too much jargon and failing to make their science relevant to a non-scientific audience (Hartz and Chappell 1997). Scientists are generally adept in very specific research areas and unfamiliar with how their research might fit into broader issues (or even with other scientific disciplines). Scientists also may qualify their claims with so many ifs, ands and buts that journalists find it difficult to create a compelling news story.

In addition, popularising science is generally looked down on in the scientific community (Shortland and Gregory 1991), and peer acceptance is usually more important for scientists than public acceptance (McCall 1988). Therefore, many scientists feel no obligation to help journalists and may in fact make it difficult for journalists to do their job. Journalists say that scientists do not understand their short time-frames and thus may fail to provide information on short notice or resist any press coverage at all before the story is already 'old news'.

On the other hand, scientists are also highly critical of journalists, pointing out that the media frequently ignore both the *process* and the *substance* of science (Nelkin 1995). Journalists tend to ignore the scientific process by focusing on events rather than in-depth scientific issues or concepts (Nelkin 1995). In particular, scientists are critical when journalists rely on "pre-packaged" information such as press releases and "staged" events managed by public relations offices (Shepherd 1979;1981; Wilkins and Patterson 1987; Nelkin 1995; Angell 1996; Saari et al. 1998).

Moreover, when journalists cover scientific events, they tend to cover them in an episodic fashion rather than providing background and context (Wilkins and Patterson 1987; Logan 1998). Thus, by focusing on "miracle cures", "magic bullets" and breakthroughs, journalists ignore the sociological, cultural, ethical, historical and educational dimensions of science (Pfund and Hofstadter 1981; Freimuth et al. 1984; Pellechia 1997). The media also frequently emphasise conflict, especially by balancing "duelling scientists" against each other (Dearing 1995), which may further diminish public confidence in scientific and medical institutions.

Scientists also criticise the media's tendency to cover "emerging" or "pioneer" science which is still too preliminary to merit policy or public action (Dunwoody 1999), rather than "textbook" science, which is more definitive but less newsworthy (Nelkin 1995; Logan et al. 1997; Logan et al. 2000b). This may create the false impression that preliminary data are more certain than they really are, and if no context is given, the public cannot judge the risks for themselves. This can also force legislation before an empirical grounding is established (Logan et al. 1997).

Finally, survey after survey finds that scientists' main complaint about media coverage involves inaccuracies (Dunwoody 1993). However, scientists seem to be more concerned about errors of omission than about errors of fact (Broberg 1973; Tankard and Ryan 1974; Borman 1978; Dunwoody 1982). Omissions may result in either the overstatement of results and their significance, or conversely, in the under-emphasis of the significance and applicability of the research. However, Singer (1990) also found that errors of commission were frequent in a comparison of news stories and the original research reports upon which they were based.

The differences between scientists and journalists have made it difficult for the two groups to work together to improve science coverage. Thus, much of the science communication literature suggests that the best solution to this 'cultural' barrier is to try to reduce the differences between the two groups. In some texts, the science/journalism divide is effectively distilled to a problem of training (Treise and Weigold 2002). For example, it is suggested that journalists should receive scientific training and that scientists should take courses in how to communicate through the media (McCall 1988).

However, there has been little attempt to integrate these problems of science communication into other communication theory (Weigold 2001). This is a shortcoming, as theoretical frameworks developed for mass media communication generally can help to identify and describe the various constraints under which all journalists – not just those who report science – must operate. The rest of this chapter discusses how communication theory can help us understand the social production of news and the various hierarchical forces that shape media content.

## 2.4. Media theory: The social production of news

### 2.4.1. The theory of 'gatekeeping'

Shoemaker et al (2001, p. 233) define "gatekeeping" as "the process by which the vast array of potential news messages are winnowed, shaped and prodded into those few that are actually transmitted by the news media." The general process of gatekeeping was first proposed by psychologist Kurt Lewin (1947) in his research on how social change might occur by affecting food consumption. He suggested that food moves step by step through "channels" that are controlled by a "gatekeeper" who determines which food items enter the home and are used by the family. The passage of food items through each channel is determined by "forces", which can either facilitate or constrain their passage from production to consumption.

David Manning White (1950) was the first to apply Lewin's theory of gatekeeping to the media, using a case study of a wire service editor's selection of daily news. White studied the stories selected by a newspaper editor he called "Mr. Gates" and then questioned the editor about his decisions. White concluded that Mr. Gates's decisions were influenced by his personal beliefs and that his choices showed "how highly subjective, how reliant upon value-judgements based on the 'gatekeeper's' own set of experiences, attitudes and expectations the communication of 'news' really is" (White 1950, p. 386).

Lewin and White's gatekeeping work was important because it brought into focus "the intuitive notion that not all that happens in the world gets into the news" (Reese and Ballinger 2001, p. 647). Communication scholars now had to accept that news is a socially constructed product, not just a reflection of events. Until this point, most communication research had focused on the effects that media content has on audiences, but as the gatekeeping theory became accepted during the 1960s, more research began to be directed into the forces that shape media messages.

These studies showed over and over again that news does not correspond to an 'objective' reality (and in fact questioned whether a single reality exists to be captured in the first place). For example, one of the earliest studies by Kurt and Gladys Lang (1971) analysed the 1951 MacArthur Day parade in Chicago and found that its representation on television differed in important ways from the personal experience of being there. Similarly, Combs and Slovic (1979) studied newspaper coverage of various causes of death and found that the coverage of different causes did not simply correspond to their frequency of occurrence. News also consistently over-represents certain geographic regions and developed countries (Singer et al. 1991).

Thus, Lewin and White's basic conception that news is a manufactured product that does not just reflect reality and is shaped by various forces is widely accepted today. However, the gatekeeping concept has also been refined in several ways. First, the concept was originally construed as a series of discrete decisions that determine whether messages are selected. However, as Bass (1969) pointed out, the news process includes both gathering and processing stages. The media not only make choices about what news to select from a vast amount of possibilities, they also shape or "frame" that content in certain ways. Today, gatekeeping is defined as "the overall process through which the social reality transmitted by the news media is constructed", which includes not only selection but also how news messages are shaped and presented (Shoemaker et al. 2001).

Second, White (1950) focused on how personal values and judgments influenced one journalist's decisions, but subsequent studies have shown how media routines also influence journalists' decisions. White's focus on the individual level assumed that the editor had an entire range of world events to choose from, but actually he was choosing from a much smaller subset of news provided to him by wire services. Gieber (1964) showed that 16 wire editors made similar choices, which suggests that other routine constraints limited their individual decisions and caused them to pick the same stories.

Similarly, Hirsch (1977) re-analysed White's data and found that Mr. Gates selected stories proportional to the coverage of the issues provided by the wire service. Likewise, Whitney and Becker (1982) gave two groups of editors a set of stories, where one group was given stories unevenly distributed across seven categories and the other group were given stories equally distributed from the seven categories. The editors selected stories according to their proportion in the source copy when the category distribution was unequal, but they used more individual judgments when category distribution in the source copy was equal.

During the 1980s, media scholars increasingly recognised the importance of forces beyond the characteristics of individual journalists. They noted a similarity in coverage across media organisations and over time as the media "converged" on big stories, which suggested that organisational and institutional forces shape content (McCombs and Shaw 1993, p. 313). This concern for higher level forces is reflected in the communication parlance that developed. Specifically, the phrase "media agenda-setting" extended the application of a phrase ('agenda-setting') that had previously only been applied to audiences and public policy (e.g. Rogers and Dearing 1988). Thus, new links were forged with the sociology of news literature, which emphasised not only what forces shape content but also the importance of who controls the media agenda.

### 2.4.2. A hierarchical model of the forces shaping media content

Research on media content has tended to focus more on the effects of news on audiences rather than on the forces that influence how journalists select and frame the news (Shoemaker and Reese 1996). However, since Lewin and White's original gatekeeping work, an increasing number of studies have explored the diverse forces that shape media content. Shoemaker and Reese (1996) organised these forces into five hierarchical levels: individual, routine, organisational, external (or institutional) and ideological. This model is a useful way to study the various forces that interact to produce patterns in media content. Traditionally, European media studies have focused on ideological and institutional analysis, while American studies tend to concentrate on the individual and routine levels (Reese and Ballinger 2001). In this section, I will first discuss general communication research on each level in the model, and then in the next section, I apply the model specifically to science reporting.

#### *2.4.2.1. Individual-level forces*

At the individual level, Shoemaker and Reese (1996) describe four dimensions according to which journalists may differ:

1. personal characteristics (e.g. age, gender, ethnicity, sexual orientation);
2. personal and professional background (e.g. religious upbringing, socio-economic status, education);
3. personal attitudes, values and beliefs (e.g. political attitudes, religious orientations); and
4. professional orientations and role conceptions (e.g. whether journalists see their role primarily as dissemination or interpretation; Johnstone et al. 1972).

The first two of these factors, demographics and background, do not have a direct effect on media content but may indirectly influence content through their effects on the personal and professional attitudes and roles of journalists. Shoemaker and Reese (1996, p. 102) suggest that professional roles probably have a greater effect than personal attitudes because "not only is the suppression of personal attitudes, values and beliefs part of the professional communicator's role; the exertion of personal will within a mass media organisation takes more power than most communicators can wield."

Empirical studies show conflicting results as to extent of individual-level forces on media content, but personal attributes probably have a greater effect on content when the journalist has more power within the news organisation and when they work under fewer constraints (Shoemaker and Reese 1996; Napoli 1997). Much of the empirical work on individual factors has focused on the effects of ideology, age and gender on content (Peiser 2000). For example, surveys show that age can affect news decisions (e.g. Lang et al. 1993), which is significant since journalists are generally younger than the general public. Gender may also have an influence on content because there is preliminary evidence that women and men show some differences in the types of stories they are most concerned about (Weaver and Wilhoit 1996). There is some evidence that a journalist's ideology influences content (e.g. Flegel and Chaffee 1971), although this has not been thoroughly tested (Peiser 2000).

Despite the abundance of communication research on individual-level forces, most of these studies have focused on reporters (e.g. Robinson et al. 1982; Becker et al. 1987; Weiss and Singer 1988; Nelkin 1995; Weaver and Wilhoit 1996; Hartz and Chappell 1997; Weaver 1998), even though individuals throughout media organisations may have an important influence on news content. The characteristics of editors and managers – who have significant power in news production – are largely ignored (exceptions include Boyer 1981; Peterson et al. 1984; Hewitt and Houlberg 1986; Demers 1991; Clayman and Reisner 1998) and almost no studies have looked at the effects of the personal attributes of owners and executives (Napoli 1997).

*2.4.2.2. Routine forces*

At the next higher level in Shoemaker and Reese's (1996) hierarchy, journalists act according to media routines, or "the habitual, ongoing, patterned procedures that are accepted as appropriate professional practice" (Shoemaker and Reese 1996, p. 17). Routines do not develop randomly but are practical responses to the constraints on media organisations and their workers, given limited resources and an abundance of news material.

News routines are established because they help news organisations function on a day-to-day basis and to gather and process news in systematic and predictable ways (Reese 1991; Shoemaker and Reese 1996; Abel 1997). More specifically, Hall et al. (1978) suggest that routines enable journalists to claim accuracy and objectivity. Following routines may buffer journalists from criticism and even legal suits, because journalists can claim that their actions were consistent with professional procedures (Tuchman 1972; Shoemaker and Reese 1996). However, routines can also be controlled or exploited by news sources (Reese 1991). For example, journalists' reliance on routine channels of information (see below) may enable sources to control the information received by journalists to a greater extent.

The strong similarities in news across diverse media suggest that routines are important in shaping media content (Shoemaker and Reese 1996). Among the most important routines are: 1) the use of news values in the gatekeeping process, 2) a reliance on official sources and routine channels of information, 3) objectivity, 4) short deadlines and 5) news gathering or "organisational" routines, such as wire services and the system of news rounds.

### NEWS VALUES

News values, or "craft norms" as they are also called, are one of the most important routines that provide guidelines for the selection, construction and presentation of news. News values offer a systematic way for journalists to judge an event's potential audience appeal in the absence of direct feedback from the audience about what issues interest them (Shoemaker and Reese 1996).

News values function only as loose considerations, not as strict criteria for the selection of events (Gans 1979), and they are shared operational values that are not explicitly stated but that journalists learn through initiation and socialization in the newsroom (McGregor 2002). Journalists can use news values in their day-to-day decisions to determine which stories should make the news and how they should be framed. Events or issues with high news value (often called "newsworthy") will be more likely to get space than those with little news value, and journalists will tend to emphasise news values in the stories they present.

Although they are not codified, a relatively uniform set of news values tend to be widely shared by different news media around the world (Hall et al. 1978). Galtung and Ruge (1965) published the seminal paper on news values that identified twelve interrelated values, including eight general factors and four culture-bound factors important only in Western developed countries. The general factors are: frequency, threshold, unambiguity, meaningfulness, consonance, unexpectedness, continuity and composition. The remaining four factors relevant to Western countries are: events concerning elite nations, events referring to elite people, events that could be personalized or personified and news with negativity.

This typology remains fundamentally unaltered and unchallenged today, although various authors have described slightly different categorizations.[1] McGregor (2002) proposes some minor alterations to this scheme given the considerable changes that the media have undergone during the last 30 years (especially the rise of television and an increase in commercialisation). First, she suggests that Galtung and Ruge's (1965) "frequency" value (which originally meant that events are more likely to become news if they occur at a similar rate to the frequency of the news medium) is no longer relevant because media cycles are now continuous and events become news instantaneously. However, several authors have noted that the newsworthiness of science may be hindered by the fact that science does not match the news-frequency of the press (Friedman et al. 1986; Hansen 1994; Nelkin 1995). Science is a slow, gradual process and events rarely fit within the 24-hour cycle of media reporting.

In addition, McGregor (2002) suggests four additional factors that are also noted by various other authors (e.g. Hall et al. 1978; Nelkin 1995; Shoemaker and Reese 1996; McComas and Shanahan 1999; Logan et al. 2000b):

1. Visualness: The ability to get pictures but also the visual potential of the story. Visualness may be particularly important for television (Abbott and Brassfield 1989), but even print media are increasingly driven by design considerations.
2. Emotion: Tragedy, human interest, survivors, children and animals all appeal to our emotions and have become important values with the rise of commercialisation. This is similar – although perhaps distinct in some respects – from the factor other authors have referred to as "drama" (e.g. Hall et al. 1978; Shoemaker and Reese 1996).
3. Conflict and controversy: News is driven by a conflict format that enables journalists to satisfy the criteria of balance and fairness.
4. 'Celebrification' of the journalist: As journalists increasingly provide interpretation, analysis and comment on the news, journalists become part of the news.

[1] For example, Shoemaker and Reese (1996) suggest the following six values: prominence, human interest, conflict/controversy, the unusual (novelty), timeliness and proximity. Masterton (1998) follows this list but replaces "timeliness" with "consequence".

They become "instant experts", particularly on television, where their personalities are integral to their "performance" as news sources as well as presenters.

### A Reliance on Routine Channels and Official Sources

In 1973, Leon Sigal conducted a now classic study on source-use in twenty years of front-page news in the *New York Times* and *Washington Post*. He found that in the majority of stories (58.2%), journalists relied on certain "routine channels" of information: official proceedings, press releases, press conferences and "non-spontaneous" events (e.g. speeches and ceremonies). Only one quarter of the stories originated through the journalists' own initiative, such as the witnessing of a spontaneous event or independent research or analysis (Sigal 1973). Numerous other studies have shown this reliance on routine channels and the lack of journalistic initiative (see Reese 1991). For example, Sachsman (1976) found that journalists relied heavily on press releases about environmental issues.

In addition, a great deal of research suggests that journalists also tend to rely on official sources (e.g. Sigal 1973; Gans 1979, Fico, 1984; Soloski 1989), who often communicate through these routine channels. For example, a number of studies have shown that the media generally rely on public officials and industry spokespersons rather than local activists when reporting environmental conflicts (e.g. Mazur 1981; Smith 1993; Taylor et al. 2000).

Reporters rely on official sources because they provide a regular flow of information that requires little work and few resources (Hall et al. 1978; Fico 1984; Tidey 2002). The views and comments of official sources can often be predicted beforehand (Shoemaker and Reese 1996), and sources at institutions or recognised organisations are easier to access than individuals, because they are more visible to the media and because they have regular office hours and easily reached points of contact (Shoemaker and Reese 1996).Official sources also provide authoritative validation because they are presumed to be unbiased and impartial (Paletz and Entman 1981; Gandy 1982; Steele 1990);

### OBJECTIVITY

Objectivity is "one of the hallmarks of traditional journalism" (Willis 1991, p. 53), especially in the United States. However, today many authors believe that it is "less a core belief of journalists than a set of procedures to which journalists willingly conform in order to protect themselves from attack" (Shoemaker and Reese 1996, p. 112). Objectivity enables journalists to remain autonomous in choosing news (Gans 1979) and to meet deadlines (Durham 1998), and it protects them from libel suits and editorial reprimands (Tuchman 1972; 1978).

Tuchman (1972) has described objectivity as a "strategic ritual" that includes such practices as relying on verifiable facts, balancing conflicting truth-claims, using quotation marks, attributing quotes to named sources, using the inverted pyramid structure and separating facts from interpretation. Objectivity will be discussed in detail when two of these practices – verification and balance – are explored further in Chapter 3.

### DEADLINES

Deadlines force all journalists to process information within tight time-frames, and therefore deadlines have many effects on what news is gathered and how it is presented. Limited time means that reporters often work from "pre-defined angles" and that they seek out familiar sources, because they can predict in advance what information they will be given (Shoemaker and Reese 1996). Moreover, strict deadlines may force journalists to be dependent on "pre-packaged" information such as press releases, "prescheduled" events such as press conferences, public relations officers and a small number of official sources. Deadlines may also force journalists to rely on single sources rather than seeking out different views, and to rely on institutional leaders and routine institutional activities (Dunwoody and Wartella 1979; Dunwoody 1980). Proximity to the journalist's deadline can also act as a negative force, so that events that occur close to the deadline are less likely to get covered (Abbott and Brassfield 1989).

Deadlines may also force journalists to rely heavily on each other for story ideas, information, contacts, guidance and to confirm their own news judgments (Dunwoody

1980). The latter is necessary because journalists do not have external benchmarks against which to judge themselves, so they use each other to "cross-validate" their work (Reese 1991, p. 333). This "pack mentality" may be one reason that news is so similar across different media (Shoemaker and Reese 1996).

### Organisational Routines

Organisational routines are the systematic ways that newsrooms gather news. The two most obvious organisational routines are the use of wire services and the "round" system. Editorial conferences are a third, less studied routine.

Wire services help news organisations by reducing the constraints on journalists. Using news services makes it possible even for small news organisations to produce a steady stream of information despite limited resources, by reducing the amount of news that their own reporters are responsible for (Shoemaker and Reese 1996). Small dailies and broadcast stations are less likely to have time or money for in-depth coverage (Ward 1992), so they may rely on wire services more heavily (Friedman 1986; Lacy and Bernstein 1988). In particular, wire services may be useful for international news and speciality reporting, which require more money and time to cover. The selection of news from wire services influences media content, because another set of news workers at the wire agency have already selected a sub-set of news stories to provide over the wire. Studies have shown that editors tend to follow the overall proportions of topics that wire services provide (Hirsch 1977; Whitney and Becker 1982).

The round, or "beat" system as it is called in the United States, is another routine that helps news organisations gather reliable news. Tuchman (1972) calls this system the "news net", because it defines which events are likely to be covered. Events that fall neatly under a dedicated round will be more likely to be reported than events that are not directly relevant to any dedicated round.

A third organisational routine that has been largely overlooked is the editorial conference, where editors decide which stories should be selected over others and where each story should be placed. A study of these meetings by Clayman and Reisner (1998) shows that editorial staff negotiate and promote particular stories over others. Thus, story selections are not only influenced by news values but also by what the editors do and say during these conferences.

### *2.4.2.3. Organisational forces*

The third level in Shoemaker and Reese's (1996) hierarchy involves organisational forces that influence news decisions. Organisational forces include the goals of news organisations (e.g. profit versus public service), ownership patterns, the structural arrangement of news organisations into sections and teams and the nature of the news medium (i.e. print, radio or television). These factors create an institutional context that "systematically narrows the pool of available stories" as well as affecting how the chosen stories are presented (Clayman and Reisner 1998, p. 197).

The fact that journalists at different types of news organisations (e.g. broadcast and print) act in comparable ways suggests that they are responding to organisational similarities (Shoemaker and Reese 1996). A number of authors have emphasised the importance of organisational factors in understanding the context for the production of media content (e.g. Bagdikian 1973; Hirsch 1977; Tunstall 1991; Napoli 1997).

#### ORGANISATIONAL GOALS

For most news organisations, their primary goal is to make a profit. Economic imperatives can influence news story selection (Epstein 1974), format decisions (Underwood 1993) and the style of news presentation (Bennett 1988). Specifically, news organisations may feel the need to enhance audience appeal, which can result in an increase in sensationalism and an emphasis on entertainment criteria (e.g. violence, drama, sex and celebrity coverage; Abel 1997). For example, increasing commercialisation in New Zealand television has caused a decrease in the length of sound bites and a shift toward "lighter" topics and away from economic, political and industrial news (Horrocks 1996; Comrie 1999). In addition, profit-driven organisations must trim their production budgets, which often translates into less time and money for newsgathering. Journalists also may be pressured to provide content that does not alienate advertisers or contradict messages in their ads (Shoemaker and Reese 1996).

The drive to maximise profits may help explain some of the news values that others have suggested drive news selection (Napoli 1997; Clayman and Reisner 1998). Gans (1979) proposed that the two dominant news selection criteria (particularly for choosing sources) are "availability" and "suitability", but Napoli (1997) observes that these values also serve to maximise profits. Readily available news is also the cheapest to gather, and characteristics that make news "suitable" also maximise the potential audience. Bennett (1988) also noted that tendencies to personalise, dramatise, fragment and normalise are all ways to appeal to the widest possible audience.

### OWNERSHIP PATTERNS

The worldwide trend is towards global media conglomeration, and by 2001, just seven multinational corporations had come to dominate media around the world (McChesney 2001). This increasing consolidation of media ownership has probably encouraged a bias towards large-scale corporate interests, and it has led to a decrease in the diversity of news content (Stempel 1973; Shoemaker and Reese 1996).

Several studies have also shown differences between independently-owned and corporate-owned chain newspapers. Donohue et al (1985) showed that chain newspapers have less local content than independent ones. Similarly, Parsons et al (1988) showed that journalists in chain newspapers see themselves as having a role as a member of the larger news organisation, which may detract from their role in the local community and encourage them to feel less responsible to the community.

In addition to all of these general effects on content, ownership patterns may also supersede the media routine of objectivity to influence the specific editorial slant and policy of news organisations. For example, Rupert Murdoch has used his media assets to promote a conservative political agenda as well as forcing sensationalism to boost circulation (Shoemaker and Reese 1996). However, constant and systematic intervention by ownership in the news production process is impractical (Napoli 1997), so owners need other ways to exert their control. Owners may create explicit editorial policies, but they more frequently rely on unwritten and unarticulated policies to persuade their news workers to conform to their own objectives. Another strategy owners may use is to hire like-minded individuals (Epstein 1974), thereby creating a greater congruence between ownership and management objectives (Napoli 1997).

### Organisational Structure

Shoemaker and Reese (1996) outline three general levels within media organisations: 1) writers and reporters; 2) managers, editors and producers; and 3) executives and owners. The role of news workers within this hierarchy influences their power and shapes their views, and hence affects the media content they produce. For example, reporters tend to be more concerned with their sources' views, while editors tend to be more audience-related (Gans 1979). Furthermore, the relationships between news workers at each of these levels can influence media content (Napoli 1997). The relative autonomy of reporters from editors and editors from owners has a considerable impact on how free news workers are to express their own individual values and priorities.

The structure of news organisations also influences content because it partially determines which topics receive the most resources and the most coverage. For example, a large organisation with a number of specialised reporters will cover news differently from a small organisation that only has general reporters. Furthermore, organisational structure can influence not only topical priorities but also the type of news content that is produced. For example, Lacy and Bernstein (1988) found that larger newspapers are more likely to generate their own content, whereas smaller papers are more reliant on wire service copy.

### The News Medium

Broadcast organisations – and in particular television networks – face unique constraints on the production of news to those faced by print media. The constraints on television include the need for visuals, special technical production criteria, limited air time and the need to maintain an audience by keeping them interested (Abbott and Brassfield 1989; Abel 1997). Economic considerations are also especially influential on television, because unlike most newspapers, which tend to have few other papers to compete with in their local market, television networks must compete for the same national market.

Moreover, television audiences can choose another station at any time with a flick of their remote control and news is a key way that networks "channel" their audience into prime-time programming (Hallin 1986b). Thus, Hallin (1986b, p. 11) suggests that television news is now a mixture of "journalism and show business, a key political institution as well as a seller of detergent and breakfast cereal."

As a result of these constraints, cost-cutting measures (e.g. hiring fewer staff; less background research) are more common and pronounced for television than for radio and print organisations (Shoemaker and Reese 1996). These economic constraints have a range of effects for the production of news, such as a heavy reliance on predictable events (to enable camera crews to be assigned beforehand) and a greater dependence on sources for information (Friedman 1986).

Perhaps most importantly, commercial constraints and the drive to maximise audiences has led television news to emphasise entertainment values more than print media. In particular, television news places higher priority on conflict, drama and emotion. Horrocks (1996) claims that changes in New Zealand television since deregulation in 1988 have led to increased emphasis on accessibility, human interest, emotional impact and a "feel-good" mood, while rejecting dry, highbrow programming. Television news has also moved toward shorter sound bites, with more limited time to present each story.

Another key difference between broadcast and print media that is particularly relevant to this thesis is their different approaches to the notion of journalistic balance. Print journalists are required to provide a fair and balanced account of all relevant sides within each story. Broadcast standards, on the other hand, dictate that all significant points of view are presented "within the period of current interest" (according to the Broadcasting Act 1989; see http://www.bsa.govt.nz/codeidx.htm#bcact).

#### *2.4.2.4. External forces*

The fourth level of Shoemaker and Reese's (1996) hierarchy consists of forces that influence news organisations from the outside. These external or "institutional" forces include pressure from news sources, interest groups, audiences, advertisers and the government.

Sources can influence content in numerous ways; for example, by withholding information, by monopolising the journalist's time, by misleading the journalist or by providing a context within which all subsequent arguments are evaluated (Hall et al. 1978; Shoemaker and Reese 1996). Because sources with economic or political power are more likely to understand media routines, these elite sources may be more likely to gain and shape coverage and to have their views legitimised (Hall et al. 1978; Gans 1979; Shoemaker and Reese 1996).

Interest groups may also be experienced in using media routines to air and advocate for their viewpoints. However, public relations officers make the most overt attempts to influence the media. They write press releases and organise "pseudoevents" (demonstrations, press conferences, ceremonies or speeches designed to get media attention) that can affect media priorities as well as their framing of certain topics.

Both media audiences and advertisers can have a great influence on media content, particularly when commercial pressures are high. Advertisers may dictate editorial priorities either by directly protesting against certain content that is not in line with their ads, or by encouraging the news organisation to produce content that will 'capture' the right target audience for their ads (Shoemaker and Reese 1996). Audience members may influence the media through editorials or by protesting or praising certain content, or more importantly, through the revenue they provide both directly (i.e. subscriptions) and indirectly (i.e. increased market share which boosts advertising potential).

Characteristics of the community that a media organisation represents also can influence news content. For example, metropolitan newspapers may be more critical than small town papers (Lacy and Sohn 1990), whose role is usually to be supportive and to promote local interests (Case 1993; Dunwoody and Griffin 1993; Griffin and Dunwoody 1995). Similarly, Tichenor et al (1980) found that coverage in low-pluralism communities works more on consensus, whereas more conflict is reported in high-pluralism communities. Taylor et al (2000) found that environmental coverage in a "fragmented" community (small but with high pluralism) legitimised local industry while marginalizing local activists.

The government may influence media content through legislation or via regulatory bodies that set standards for media behaviour. In New Zealand, the Broadcasting Standards Authority (BSA) is the statutory watchdog responsible for ensuring that broadcast media observe their approved codes of practice. Members of the BSA are appointed by the Governor General on recommendation by the Minister of Broadcasting.

#### *2.4.2.5. Ideological forces*

The fifth and final level in Shoemaker and Reese's (1996) hierarchy is the ideological, or "systems" level, which determines the cultural acceptability of certain types of news at a societal level. Williams (1977, p. 109) defines ideology as "a relatively formal and articulated system of meanings, values and beliefs, of a kind that can be abstracted as a 'world-view' or a 'class outlook'." Examples of ideological values in the United States are the capitalist economic system, private ownership, the free market, the focus on individual achievement and a belief in democracy and freedom of expression (Shoemaker and Reese 1996).

Many of these values are shared by most Western developed countries, including New Zealand. However, differences in cultural and economic development in Europe, Australia and New Zealand have led to differences in their media coverage (Eide and Ottosen 1994; Metcalfe and Gascoigne 1995; Hutchison and Lealand 1996). In particular, authors have noted that the objectivity norm is interpreted and valued differently in various countries (Donsbach and Klett 1993; Chalaby 1998).

#### *2.4.2.6. Comparing factors at different levels*

Forces at Shoemaker and Reese's (1996) five hierarchical levels are not independent; rather they interact in complex ways so that whether an event or message becomes news (and exactly how it is shaped and presented) depends on the relative intensity of the various forces at each hierarchical level. Differences among these forces create the potential for conflict over political, professional and economic objectives. For example, a journalist's personal values and ethics may conflict with the organisational pressure to report within deadlines and to capture exclusives.

On the other hand, forces at different levels may reinforce each other to result in certain constraints. For example, at the routine level, deadlines limit the time that journalists can spend on each story, and time constraints are also caused by organisational factors, such as economic motives that constrict staffing and resources for reporting. In this sense, the routine of strict deadlines serves organisational needs well because stories that are short are also cheaper to produce and have greater audience appeal.

Likewise, balancing opposing truth-claims against each other is a practice encouraged by various forces at different levels, including objectivity, limited time and limited expertise and experience. The tendency for journalists to rely on official sources is also primarily a routine practice, but it is also encouraged by time constraints and individual-level factors (e.g. if the journalist does not have experience in the topic being covered, s/he may defer to an official "expert").

Clearly forces at all levels are responsible for the patterns in media content that we observe. However, research suggests that not all levels have an equal influence on news content. Such research has tended to show that individual factors are less likely to have an effect compared to routines and organisational constraints, which encourage journalists to suppress their personal attitudes, values and beliefs (Weaver and Wilhoit 1991; Stocking 1999). For example, Shoemaker et al (2001) examined newspaper stories about fifty American Congressional bills and found that none of the studied individual forces (i.e. years as a journalist, education, race, gender and political ideology) were statistically related to the quantity with which bills were covered, but "newsworthiness", or the news value of a bill, was a significant positive force driving coverage. Gans (1985) even suggested that organisational constraints and professional norms may effectively remove personal effects from news coverage altogether.

However, some communication scholars have questioned this position, maintaining that personal factors may have more influence in certain situations than in others. For example, Peiser (2000) found that both individual and organisational factors influenced which news issues German journalists considered important. A logistic regression showed significant effects from media type, department, age and especially gender.

Reporters' attitudes and opinions often differ from their editors (Breed 1955; Epstein 1974), and Napoli (1997) suggests that reporters may be free to act according to their own opinions unless their superiors conduct sufficient "monitoring". In a similar way, editors have a certain degree of "slack" from the organisation's owners. However, little research has been conducted to determine what conditions influence how much news workers can base their decisions on personal rather than routine and organisational criteria (Hirsch 1977; Napoli 1997). In addition, personal factors may also be underestimated because of their confounding effects on certain organisational factors. For example, journalists tend to self-select the type of media and department that they work for (e.g. a sports department will probably be filled with individuals who have a personal interest in sport; Peiser, 2000).

## 2.5. Forces shaping science content in the mass media

Empirical research on the specific forces that influence scientific media content is limited (Stocking 1999), but a number of potential forces have been identified. Below is a list of the primary factors at each level that have been proposed to influence media content about science.

### 2.5.1. Individual level:

- <u>Scientific training and experience reporting science</u>: Most reporters typically have little formal scientific training (Weaver and Wilhoit 1991; Nelkin 1995), and several authors have suggested that this may contribute to inaccurate scientific reporting (Nelkin 1995; Hartz and Chappell 1997). There is debate about how important (and even desirable) formal training is though (Weigold 2001), and the few empirical studies have mostly failed to find a link between scientific training and the quality of reporting (Weiss and Singer 1988; Wilson 2000;2002). On the other hand, Weiss and Singer (1988) showed that experience reporting science had a weak effect on the quality of science reporting.
- <u>Personal values, attitudes, experiences and beliefs</u>: In particular, personal connections to science and how aligned the journalist's concerns are with scientific

concerns (e.g. the importance of caveats, peer review, hypothesis testing) may affect science coverage (Stocking 1999).

- Professional roles: Many journalists view themselves as translators of scientific information, who simply "report the facts" and translate complex scientific language into simpler terms for the public (Dornan 1990; Dearing 1995). Thus, critical debate, analysis and investigation of scientific issues appears to be rare.

### 2.5.2. Routine level:

- News values: Wartenberg and Greenberg (1992) showed that journalists prioritise scientific issues based on news values (especially human interest, controversy and surprise) rather than scientific criteria. A number of other studies have emphasised the importance of drama in science coverage (Greenberg et al. 1989; Mazur and Lee 1993; McComas and Shanahan 1999). The drive for news values such as drama, novelty and controversy have led to a number of practices that scientists and science communicators criticise:
  - ⇒ Producing sensationalised 'breakthrough' stories (Burkett 1973; Nelkin 1995);
  - ⇒ Ignoring scientific caveats and uncertainties (Stocking 1999);
  - ⇒ Covering "emerging" science that is only supported by preliminary data (Dunwoody 1999) rather than "textbook" science that is well-established (Logan et al. 1997);
  - ⇒ Emphasising human interest at the cost of other contextual information that would explain the significance of the science (Blakeslee 1986; Nelkin 1995);
  - ⇒ Writing about fringe or maverick scientists for their novelty value (Stocking 1999); and
  - ⇒ Over-emphasising controversy and conflict amongst scientists (Cole 1975; Efron 1985; Burnham 1987; Miller 1992; Wilkins 1993; Dearing 1995; Wilson 2000).
- Reliance on routine channels: A reliance on routine channels of information may lead science journalists to focus on press releases and "staged" events that are managed by public relations offices (Shepherd 1979;1981; Wilkins and Patterson 1987; Nelkin 1995; Angell 1996; Saari et al. 1998). This can decrease the diversity

of science news (Nelkin 1995) and reinforce the media's dependence on established sources. It also causes journalists to cover long-term issues in an episodic fashion rather than providing background and context (Caudill 1987; Wilkins and Patterson 1987; Dunwoody and Griffin 1993; Detjen 1995; Pellechia 1997; Logan 1998), and to ignore the sociological, cultural, ethical, historical and educational dimensions of science (Pfund and Hofstadter 1981; Freimuth et al. 1984; Pellechia 1997).

- Reliance on official sources: Some research suggests that journalists tend to rely more on government officials and administrators than scientists. For example, Hornig et al (1991) found that journalists were more likely to use government sources than technical experts in covering environmental disasters. Likewise, Shepherd (1981) found that in coverage of the marijuana controversy, the press gave minimal attention to researchers who were frequently cited in the scientific literature, and seven of the ten most frequently cited authorities were administrative officials. Source credentials may be one of the main ways that journalists evaluate scientific claims (Rowan 1989).
- Objectivity: Frequently, journalists will present opposing scientific views in the interest of objectivity (Dunwoody 1999), but two sides may often be given equal weight despite unequal evidence or support from the scientific community for their claims. Dearing (1995) suggests that the public often believe a maverick over the scientific establishment because the former excites sympathy, fear or superstition.
- Deadlines: Tight deadlines may force journalists to write single-source stories (Dunwoody 1980) or to rely on a small group of experts even when the topic is outside their area of expertise. Time constraints can also lead to preferences for "pre-packaged science" (e.g. press releases and press conferences), and may increase the influence of public relations officers and agencies on the media (Einsiedel 1992). Deadlines can be particularly problematic when stories involve complex scientific topics that require considerable time to understand. Under time constraints, journalists might not be able to understand the topic themselves, let alone give any background or context to their audience. Finally, deadlines can also force journalists to rely on each other for information and sources. Dunwoody (1980) described this as an "inner club" of science journalists who pool resources in deciding what and how much coverage to give each story.

- Science rounds: Several studies have shown that full-time science or environmental reporters produce better quality reporting than general reporters (Einsiedel and Coughlan 1993; Hartz and Chappell 1997; Wilson 2000).

### 2.5.3. Organisational level:

- Economic imperatives: Commercialism is probably the ultimate cause of the dearth of resources allocated to science reporting at most news organisations (Saari et al. 1998). Commercial pressures and the push for exclusives can reinforce the time constraints imposed by deadlines to force journalists to produce science stories quickly, often without sufficient verification, background research or critical analysis (Dunwoody 1980; Saari et al. 1998; Dunwoody 1999).
- Editors and producers: Editors and producers may present a formidable barrier to science reporting, because many are uncomfortable with science themselves and have little experience or training in science (Blum 2002). In general, editors seem to believe that public interest in science is much lower than public opinion surveys suggest (Crane 1992). Editors may tend to cut science stories because advertising is difficult to find for science sections (Detjen 1995). Furthermore, editors may have different standards than reporters or scientists for judging science stories (Burkett 1973; Nelkin 1995). Johnson (1963) found that journalists, scientists and readers thought that the most "newsworthy" stories were those that were the most accurate and significant, while editors thought that colour and excitement were most important.
- Special constraints of television: Because television requires visual images for all stories, it is difficult to adapt many science stories for television. In particular, the physical sciences are hard to portray visually, while technology, social science and environmental issues are easier to depict (Gregory and Miller 1998). The science portrayed on television must also have wide audience appeal and preferably conflict, drama or human interest (Friedman 1986). The extreme time constraints of television news (often no more than two minutes per story) also pose a challenge for communicating complex scientific concepts. Television journalists typically have less time than print journalists to conduct background research for a story.

### 2.5.4. Institutional level:

- Control by scientists: Scientists, in particular, have been effective at controlling media coverage of science (Dunwoody 1999). They may use media routines to advance their own cause or to promote science in general. Because journalists frequently rely on press releases and easily accessible scientists (often those with public relations specialists), those institutions with more resources will have more access to media attention than scientists with fewer resources (Miller 1999).
- Public relations: The public relations industry is growing and science information (SI) professionals are now common in scientific societies, universities, research laboratories and industries (Rogers 1986). They are typically trained in journalism and not in science, and their job may be to publicise science directly or to act as a liaison between journalists and scientists. As such, they have a great deal of power in deciding what science is newsworthy, and their goal is to promote science, not to portray what is important to the public. Some studies suggest that SI mediators and press releases may actually result in more accurate reporting (from the scientists' perspective), perhaps because they "package" information in a form easily digested by the media (Dunwoody and Ryan 1983; Bell 1995). However, Eron (1986) and Kiernan (2000) found that "true" accuracy occurs more often when reporters meet directly with researchers, because the SI mediator may present the data in a biased manner.
- Interest groups: Environmental lobby groups have been especially successful at influencing journalists (Detjen 1995). However, industry can also act as a coercive force on science reporting and may lead to the cover-up of stories or to biased reporting (Nelkin 1995). For example, Nelkin (1995) says that critical environmental coverage is usually only reported on problems occurring at distant locations, since both science writers and editors may feel constrained by corporate pressure. Industry and science groups in the United States give more than 32 annual awards to science writing, and drug companies sometimes offer large payments to writers willing to plug their products without revealing their connection to the company (Anton and McCourt 1995). Scientists themselves are increasingly influenced by industry as government funding has given way to commercial support for research (Miller 1999).

- Community structure: Dunwoody and Griffin (1993; 1995) found in a case study of three Superfund sites that community structure affected the news frame, because the reporters in a small community were expected to be promoters and legitimisers of projects and "builders of consensus". In contrast, the journalists in larger communities acted as watchdogs and drew attention to local problems. The community context was also important to the way that issues were framed because other news issues (e.g. economic and land ownership issues) provided the context for how environmental issues were perceived (Dunwoody and Griffin 1993; 1995).
- News audiences: Public opinion surveys generally show that people are interested in science even if they have little knowledge or training in it (e.g. see Durant et al. 1989; Detjen 1995; Nelkin 1995; Hipkins et al. 2002). Public concern for issues such as genetic engineering and electromagnetic fields (EMFs) have partially fuelled media coverage of these topics (Wartenberg and Greenberg 1992; Priest 2000).

### 2.5.5. Ideological level:

- Social, political and cultural context: Eide and Ottosen (1994) suggest that the lack of investigative journalism among Norwegian journalists that report science can be explained partly by Norway's socio-historical context, which has encouraged a non-elitist ideology within academia that stresses their responsibility to share research knowledge with the public. Metcalfe and Gascoigne (1995) also say that Australia's unique historical and cultural circumstances have caused science journalism to evolve differently there than in the United States and Britain. No research has investigated how science coverage is affected by international differences in the journalistic conception of the objectivity norm (Donsbach and Klett 1993; Chalaby 1998).

# CHAPTER 3:

# CORNGATE: A CASE STUDY IN VERIFICATION AND BALANCE

## 3.1. Introduction

In Chapter 2, I discussed the various forces that influence the way that journalists select and shape science news. In this chapter, I now turn to two specific practices that will be examined in more detail throughout the rest of this thesis: verification and balance. Both have been the focus of criticism from communication scholars and scientists but for opposite reasons. Journalists are criticized for *not* independently verifying scientific claims, but also criticized for *using* balance to present conflicting truth-claims.

This chapter begins with a discussion of journalistic objectivity, which provides the normative basis for verification and balance. I describe how objectivity developed into an important professional norm for journalists in most Western countries and offer a conceptual framework for defining this often slippery concept. I then explain how the practices of verification and balance relate to this concept and describe some of the criticisms of the lack of verification and the use of balance in science reporting.

Finally, I illustrate how these practices can create problems in science coverage by examining a particular example of science reporting in New Zealand. Dubbed "Corngate" by the media, this case involved allegations that the New Zealand government had attempted to cover-up scientific test results that showed genetically modified corn seed had been released illegally into the country. This case illustrates how passive reporting (including lack of verification and the use of balance) may enable politicians and scientists to control the limits of debate and thereby fail to provide audiences with adequate contextual and analytical information to make their own decisions about the scientific claims.

## 3.2. Defining objectivity

Willis (1991, p. 53) has called objectivity "one of the hallmarks of traditional journalism" and Lichtenberg (1991) describes it as "a cornerstone of the professional ideology of journalists in liberal democracies." In fact, objectivity is such a central tenet in the United States that a survey of American journalists in 1974 found that 98% virtually defined journalism as adherence to the norm of objectivity (Phillips 1977).

Objectivity evolved primarily as a journalistic norm in the United States and the concept may be less restrictive in other places such as continental Europe (Dunwoody and Peters 1992). Schudson (2001) describes Britain as a "half-way house" between American journalistic objectivity and continental European conceptions of the term, because although British journalism also developed an early concern for distinguishing between fact and opinion, some media are still openly partisan in Britain today.

Despite these national differences, though, objectivity is considered an important professional value by almost all journalists in most Western countries today (Donsbach and Klett 1993). Donsbach and Klett (1993) found that trying to be as objective as possible is "very important" to most journalists in the United States (91%), and also to large percentages of British (83%), Italian (81%) and German (81%) journalists. Furthermore, Mindich (1998) notes that four of the five most widely used journalism textbooks in the U.S. tell students to be objective.

However, Mindich (1998, p.1) also notes that "even as some journalists celebrate [objectivity] and others call for its end, no one seems to be able to define it." Donsbach and Klett (1993) surveyed reporters and editors in four countries (United States, Britain, Germany and Italy) and found significant differences in journalists' definitions of objectivity among the countries. For example, most American journalists (40%) said that objectivity means fairly representing each side. British journalists (31%) also supported this definition, although their responses were more widely scattered. In contrast, most German journalists (42%) said that objectivity means going beyond statements and reporting the 'hard facts' (i.e. striving for 'true reality'), while Italian journalists were equally divided among these two definitions as well as a third meaning: a lack of subjectivity.

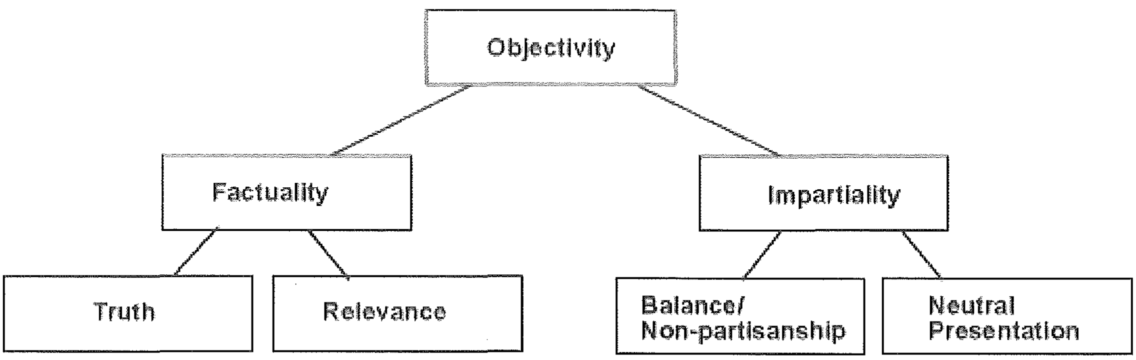
These differences in the definitions of objectivity amongst Western countries have resulted in different role perceptions; for example German journalists see themselves as more politically active than their American counterparts (Donsbach and Klett 1993). On the other hand, British and American journalists generally work more actively to get information for stories than their European counterparts (Donsbach 1995). A survey of journalism students in 22 countries also showed that students from continental Europe mentioned objectivity as a virtue less often than students in Britain, the United States, Canada and Australia (Donsbach and Klett 1993, p. 58). To my knowledge, no studies have investigated how important objectivity is to New Zealand journalists, or precisely how they define the concept. However, objectivity in New Zealand might be expected to be based on the Anglo-American tradition, given our media's close ties to Britain and the United States.

These differences amongst journalists in various countries are perhaps not surprising, but Donsbach and Klett (1993) also found that even within each country, journalists could not agree on a single definition of objectivity. Boyer (1981) came to a similar conclusion when he surveyed wire editors at 50 American daily newspapers, and they came up with 26 different elements subsumed within the concept. They could agree on the attributes contained in objectivity (e.g. balance, accuracy, presenting all relevant points, separation of facts from opinion, minimizing writer's involvement and avoiding slant or bias), but they could be divided into three groups according to which aspects they emphasised. One group emphasised balance, or presenting both sides fairly, and they largely believed objectivity is attainable. A second group said that objectivity is unattainable, but that it is a goal to strive for by minimising opinions while optimising balance. The third group also stressed the need for balance, but in a more relativistic sense of lacking bias.

### 3.2.1. A comprehensive conceptual framework

Westerstahl (1983) has presented a comprehensive conceptual framework for handling journalistic objectivity that incorporates all of these different aspects. In his model (Fig. 3.1), objectivity is used as a term to encompass and organise the various subrequirements of factuality, truth, relevance, impartiality, balance and neutral presentation. Westerstahl separates the factual dimensions of objectivity (truth and relevance) from its evaluative dimensions (neutrality and balance).

**Figure 3.1.** Westerstahl's model of the concept of objectivity. (From Westerstahl 1983, Fig. 1, p. 405).




The first half of Westerstahl's model, 'factuality', applies in all types of news organisations including partisan ones, and it incorporates two sub-categories: 'truth' factors and 'relevance' factors. The truth factors are associated with the reliability and credibility of news, and measurable features include: 1) *factualness* (i.e. distinguishing fact from opinion, attributing comments to named sources and avoiding vagueness and redundancy); 2) *accuracy*, defined variously by McQuail (1994, p. 254) as "conformity to independent records of events" or "conformity of reports to the perception of the source of news or the subject of the news" or "a matter of internal consistency within news texts"; and 3) *completeness*, defined by McQuail (1994, p. 254) as "sufficient to constitute an adequate account" (see Borman 1978; Sullivan 1985; Rowan 1989; Klaidman 1990, for further studies and discussion).

The second group of factors in Westerstahl's 'factuality' category are those associated with 'relevance' criteria. Relevance is important, because factuality and accuracy would be irrelevant if the news did not deal with events and topics of significant public concern (McQuail 1992). Relevance criteria are used to assess the quality of news *selection* (i.e. selection of a topic, of a particular event or story and of details within stories). For example, stories that enable the audience to understand an event may be considered relevant (Westerstahl 1983). McQuail (1992) points out that there are many potential criteria that could be used to judge relevance, including normative theory (i.e. what communication theory says news should be like), what journalists decide is most relevant, and what the audience finds most interesting and useful. The opposite of relevant news is trivial or 'sensational' news that is superficial, that focuses on entertainment values and that has little information value (McQuail 1992).

McQuail (1994) also suggests that a third component, 'informativeness', should be added to Westerstahl's factuality category. McQuail (1994, p. 147) defines informativeness as "qualities of informational content which are likely to improve the chances of actually getting information across to an audience." For example, techniques that help audiences notice or remember news content (e.g. personalisation, visual presentation) may make news more informative (McQuail 1992).

Unlike all of these components of factuality, the second half of Westerstahl's model, the 'impartiality' (or evaluative) dimension is inapplicable to overtly partisan sources. Impartiality includes factors related to neutral presentation and to balance or non-partisanship. According to Westerstahl (1983, p. 420), *neutrality* implies that "the report not be composed in such a way that the reporter is shown to identify with, or repudiate, the subject of the report." This may include a reluctance to take sides – particularly in the political arena – and a refusal to express personal opinions (Chalaby 1998). *Balance* has been defined either as giving equal attention to both (or all) sides, or as giving attention proportional to the significance of each view. Balance is often legally enforced; for example, through broadcast regulations such as the Broadcasting Act 1989, which stipulates that "when controversial issues of public importance are discussed, reasonable efforts are made, or reasonable opportunities are given, to present significant points of view either in the same programme or in other programmes within the period of current interest" (see www.bsa.govt.nz/codeidx.htm#bcact).

### 3.2.2. The ritual of objectivity

Westerstahl's (1983) model shows how many different elements are included within the concept of journalistic objectivity. Given that journalists emphasise different components when they talk about objectivity, how can communication scholars discuss it as a useful term and evaluate its effects on journalistic practice?

Most journalists today rarely talk about objectivity as a theoretical or ethical construct. Instead, it has been ritualised into a set of strategic procedures, or news routines (Tuchman 1972; Tuchman 1978; Durham 1998). In other words, Kovach and Rosentiel (2001) say that journalists strive for "truth" in a practical or functional sense rather than in an absolute or philosophical sense. Thus, Shoemaker and Reese (1996, p. 112) suggest that objectivity today is "less a core belief of journalists than a set of procedures to which journalists willingly conform in order to protect themselves from attack."

Objectivity does serve a number of practical purposes for news organisations and their workers. First, objectivity protects journalists from libel suits and editorial reprimands (Tuchman 1978), because journalists can deny that they make subjective judgements by contending that they use an objective methodology to make decisions (Morrison 2002). In this way, it also enables journalists to maintain autonomy in choosing the news (Gans 1979; Rosen 1993). It also obviates the need for journalists to choose between conflicting truth claims (Phillips 1977). Objectivity also helps legitimate the media (and especially their involvement in politics) by making them seem neutral, even though they may be powerful and privately-owned (Hallin 1986a). Finally, objectivity may give the news higher market-value by increasing the audience's "credence and trust in the information and opinions which the media offer" (McQuail 1994, p. 146).

Tuchman (1972) suggests that objectivity has been translated into the following six strategic procedures:

1. *Verifying facts*: Each news story is a collection of facts and the journalist is responsible for their accuracy. Some facts can be accepted as 'true', but others (mostly things that contradict common sense) must be verified (Tuchman 1972).
2. *Presenting conflicting truth-claims*: If verification is necessary but impossible, journalists must then resort to balancing alternative truth-claims. Obviously it is

impossible to provide every view on an issue, but it is generally agreed that the audience should receive a diversity of views over a period of time.

3. *Presenting supporting evidence*: To flesh out any one fact, the journalist collects an entire "web" of facts that individually – and taken as a whole – validate each other. Tuchman (1978, p. 86) says that this is necessary because "taken by itself, a fact has no meaning...It is the imposition of a frame of other ordered facts that enables recognition of facticity and attribution of meaning."
4. *Using quotation marks*: Quotation marks are a technical device used to attribute information to sources and to protect reporters from allegations that they have interjected their own opinions. Journalists may seek out sources to say things that they cannot say themselves, especially about the potential implications or importance of the source's claim (Tuchman 1978; Conrad 1999; Morrison 2002).
5. *Inverted pyramid structure*: The common structure of a news story, the inverted pyramid, begins with the "five w's" (who, what, where, when, why) or the most "material facts". This structure denotes objectivity because the reporter is not choosing the lead subjectively, but rather is following a standard, formulaic approach to writing a news story.
6. *Separating facts from interpretation*: Journalists must differentiate between "straight" news reporting versus interpretation and editorialising. Newspapers are formally divided into sections that distinguish between news, editorials, features ("soft news") and "news analysis". Television also has formal divisions and labels (e.g. headlines, business news, weather, sport, etc), which indicate a separation between fact and opinion or interpretation (Tuchman 1978).

All of these routines are evidence that journalists today continue to strive for objectivity, even though the practices may not actually bring the reporter any closer to true objectivity (Tuchman 1972). For this reason, many journalists see objectivity as a goal to strive for even if it cannot fully be attained (e.g. Chalaby 1998; Morrison 2002). For example, Mindich (1998, p. 10) says, "Although many journalists reject the idea of pure 'objectivity', they still strive for it, define themselves by it, and practice what one media critic has called the 'ritual of objectivity'."

## 3.3. A brief history of journalistic objectivity

To understand why journalistic objectivity has come to be defined in this way, and to understand why the concept is so heavily criticised today, we first need to examine the history of objectivity as a professional journalistic norm.

The idea of objectivity goes back to the Enlightenment in Europe during the mid-eighteenth century, which suggested that 'truth' could be obtained by the external observation of facts. However, up until the turn of the twentieth century, most Western media organizations held no pretext of objectivity; they were outwardly partisan. In the United States, "yellow journalism", or the manufacturing of news to make good stories that people wanted to read, flourished in the late 1800s (Willis 1991). In New Zealand, the isolation of settlements during this period made it difficult for newspapers to provide regular news coverage, and so advertising and public discussion filled in the gaps. Thus, late nineteenth century newspapers in New Zealand were argued to be the "voice of the community" and a forum for both political expression and action (Day 1990).

One frequently cited theory is that objectivity arose in the late nineteenth century because of economic and technological changes (e.g. Donsbach and Klett 1993; Emery and Emery 1996). First, the rise of the telegraph placed a premium on economy of style and led to the inverted pyramid format for writing news (Shaw 1967;1968; Carey 1989). Second, the rise of wire services and competition for an increasingly lucrative newspaper market made it more profitable to be value-free and thereby appeal to the widest possible audience across political parties. In New Zealand, newspapers began to repudiate party allegiances in an attempt to attract readers from all classes and political parties (Day 1990).[2]

[2] However, Day (1990, p. 179) points out that this rejection of party politics was "not a retreat from political involvement" but rather "an attempt to forge for the mass press a political identity and political involvement as wide as its growing readership". In other words, newspapers did not give up their role in politics, but began to see themselves as advocates for public opinion and as "the guardians of the general public welfare" Day (1990, p. 181).

This notion that the move from partisanship to objectivity was economically motivated is widely accepted (e.g. see Emery and Emery 1996), but Schudson (2001) argues that other factors were probably more important. He points out that in 1900 newspapers were still openly partisan and that readership was growing rapidly in the late nineteenth century, so there was little competitive drive to capture a limited audience. Moreover, participation in the heated political campaigns of the times boosted circulation rather than diminishing it. Thus, Schudson (2001, p. 155) suggests that "this newly aggressive commercialism in journalism was an important precondition for modern notions of objectivity or fairness, but, at first, it fostered only a narrow concept of stenographic fairness."

Instead, Schudson (1978) suggests that a more important factor in the development of the objectivity norm was that after the turn of the century, American journalism increasingly developed its own professional practices independent of political parties. For example, the interview, which was more oriented to pleasing an audience than toting a party line, became an accepted and institutionalised activity by the turn of the twentieth century (Schudson 2001). The interview was just "one of the growing number of practices that identified journalists as a distinct occupational group with distinct patterns of behaviour" (Schudson 2001).[3]

In the United States, the development of journalism as a distinct occupation created a need for social cohesion within the occupation as well as for internal social control in the newsroom. Journalists developed loyalties more to their audiences and to themselves as an occupational group than to publishers or political parties. Editors also needed ways to keep reporters under control. These needs eventually led to the articulation of the objectivity ethic as a moral ideal (not just a code of practices) in the 1920s (Schudson 2001).

---

[3] In contrast, political conditions in Europe meant that there was less "anti-partyism" there and thus less impetus for journalists to divorce themselves from party politics (Schudson 2001). It was also easier for American (and British) journalists to be politically "neutral", because with their parliamentary bipartisan systems, objectivity simply meant supporting neither of two sides. In contrast, European countries such as France had a multitude of parties, as well as more violent class struggles and political conflicts that drew newspapers into the political arena (Chalaby, 1998).

Some authors have again argued that economic forces were largely responsible for this new ethic, because the merger of Republican and Democratic newspapers in the United States in the 1920s meant that newspapers had to be non-partisan (Streckfuss 1990). However, objectivity was also a "child of its time and a creature of its culture" (Streckfuss 1990, p. 975). In particular, objectivity reflected an increasing trust in the scientific method, then being introduced throughout the social sciences. It was also a response to the rise in public relations in the early twentieth century. Newspapers sought to separate themselves from the PR industry as much as possible – to elevate journalism above propaganda to a profession (Streckfuss 1990; Schudson 2001).[4] Streckfuss (1990, p. 976) says, "Objectivity was an antidote to what liberals saw as newspaper emotionalism and sensationalism."

Ironically, Schudson (2001, p. 164) notes that "at the very moment that journalists claimed 'objectivity' as their ideal, they also recognized its limits." In fact, the ideal of objectivity was founded because of the realisation that people were not inherently objective, so reporters needed a rigorous scientific method to compensate for this (Streckfuss 1990; Willis 1991; Donsbach and Klett 1993). Walter Lippmann (1920, p. 82), one of the biggest proponents of objectivity, explained:

> ...just because news is complex and slippery, good reporting requires the exercise of the highest of scientific virtues. They are the habits of ascribing no more credibility to a statement than it warrants, a nice sense of the probabilities, and a keen understanding of the quantitative importance of particular facts.

In other words, Lippmann suggested that journalism should strive for objectivity in its methods (e.g. making news devoid of personal opinion and overtly subjective judgments; verifying and attributing facts) so that journalists would be both factual and fair (Tuchman 1978; Lambeth 1992).

---

[4] Europe did not have such an extensive development of public relations during the 1920s as in the United States, so there was less need for journalists there to distinguish themselves from the PR industry. In addition, journalists in Europe were already seen as "high literary creators and cosmopolitan political thinkers", and thus they did not need professional upgrading the way that American journalists did (Schudson 2001, p. 166).

However, this idea of journalistic objectivity as a methodology was rapidly lost; diluted, according to Streckfuss (1990, p. 983), "from a methodology needed to preserve democracy to a practical posture of day-to-day production." Objectivity soon began to be applied to the journalist rather than to the journalist's methodology, and as such, this new ideal of objectivity was characterised by three aims: 1) separation of fact and opinion, 2) emotional detachment, and 3) fairness and balance (Donsbach and Klett 1993). Willis (1991, p. 61) explains that the new idea of objectivity advised that "the idea was to act as neutral as possible, somewhat like a stenographer or a court reporter who is charged with simply taking down what is said and attributing it correctly."

Virtually from the moment this new conception of journalistic objectivity was articulated as a professional value, it was heavily criticised. In the 1940s, such criticism was articulated in Curtis MacDougall's publication of the text *Interpretive Reporting*, which advocated analysis of the news rather than editorialising. By the 1960s, objectivity had largely become "a term of abuse" in the context of journalism (Willis 1991, p. 63).

The major problem with the new definition of objectivity was that it shifted the responsibility for the validity of news content to news sources. Thus, the objectivity routine also made it easier for elite sources to control the news, because their opinions were likely to be reported regardless of whether the journalist believed their claims to be true (Donsbach and Klett 1993). The United States media began to be perceived as the voice of the establishment, and the 'objective' model was seen as reproducing the vision of the powerful and privileged without any inquiry (Schudson 1999).

Perhaps the most extreme example of such an abuse of the objectivity routine was Senator Joe McCarthy, who used the media in the early 1950s to accuse suspected communists and to ignite fear of communism in the American public (Willis 1991). Although his statements contained blatant lies, they were dutifully reported in the press because journalists felt obliged to present all views. Journalists did not spend time trying to verify his claims, because that would have implied personal doubt on the part of the reporter (Willis 1991). Thus, McCarthy was able to make unsubstantiated allegations with little interpretation, verification or context from journalists.

In the 1960s and 1970s, opposition to the objectivity model led to a surge in the establishment of advocacy newspapers and alternative journals as well as to a rise in participative journalism, investigative reporting, interpretive reporting and "New Journalism" (i.e. writing with a personal voice and in narrative style; Willis 1991; Donsbach and Klett 1993). In the 1980s, "public journalism" arose as another "antidote" to the claims of objectivity, favouring activism and community participation over neutrality and professional detachment (Schudson 1999, p. 158). However, Donsbach and Klett (1993) suggest that most of these alternative models have found only limited support. Thus, Schudson (1978, p. 193) suggests that "there is no new ideal in journalism to successfully challenge objectivity, but there is a hope for something new, a simmering disaffection with objective reporting."

## 3.4. Criticisms of the objectivity norm

The objections to journalistic objectivity are essentially two-fold: 1) that objectivity is impossible, and 2) that objectivity is undesirable anyway (McQuail 1992). Critics who argue that objectivity is impossible point out that the selection of news is necessarily a subjective process, as is the framing of news and the omission of certain stories. Objectivity implies a passive role for journalists – that they are observers rather than active constructors of a story – but actually objectivity is an "active enterprise" (Mindich 1998). Journalists must always make decisions about what topics to pursue, who to talk to, which views to present and how to present them. All of these decisions are affected by the journalist's background, education, values, class and social position.

For this reason, many critics argue that all objectivity – not just journalistic objectivity – is impossible because there is no single 'objective' reality to represent and likewise no neutral language with which to describe it (e.g. Hackett 1984). In other words, all reality is socially constructed and so everyone has their own individual perspective that shapes their view of reality. Thus, Rosen (1993, p. 49) believes that "journalism is the last refuge of objectivity as an epistemology."

In addition, critics argue that the 'objective' form of news itself is biased. Neutral verbiage can be used as an editorial tool to promote a certain set of values, and the inverted pyramid forces journalists to focus on events and conflict rather than processes or issues (Willis 1991). Morrison (2002, p. 69) thus argues that "the core problem with objectivity is that it draws journalists into a false view of themselves, their function and the world around them, and therefore leads them to dupe their readers, listeners and viewers."

Moreover, news is produced in the context of numerous pressures (e.g. competition with other journalists and news organisations, pressure from interest groups) that make objectivity practically impossible. Objectivity may be incompatible with other news values such as topicality, simplicity and controversiality, and news often has to meet other goals that may conflict with objectivity (e.g. audience appeal, a watchdog role). In addition, not all news is intended to conform to the objectivity standards (Johnstone et al. 1976). For example, accepted "non-objective news" includes human interest stories, advocacy journalism and investigative journalism (McQuail 1992; Rosen 1993).

The second argument against journalistic objectivity is that it is undesirable for various reasons. While objectivity encourages accurate reproduction (i.e. accurately reporting what sources say), it does not force journalists to challenge the validity or 'truthfulness' of those statements (Willis 1991, p. 64). In addition, balance may treat all views as equally valid with no consideration to anything but their verifiability, and so critical journalism is undervalued. Balance also can oversimplify complex issues by presenting two opposing sides and ignoring further complexities and other points of view. Glasser (1989) believes that for all of these reasons, objectivity is essentially a bias against independent thinking and responsibility for the consequences of reporting.

## 3.5. Verification

We saw from Westerstahl's model (see Fig. 4.1) that accuracy is one facet of journalistic objectivity, which suggests that news reports should be highly factual and contain as much checkable, attributed information as possible (Boyer 1981; Westerstahl

1983). Accuracy is one of the fundamental principles of journalism. In one of the most popular American journalism texts, Lambeth (1992, p. 25) states that "most fundamentally, the need is for a habit of accuracy, of checking and rechecking to establish the accuracy of questionable information."

The recent incident involving Jayson Blair, a young reporter at the *New York Times*, illustrates how important factual accuracy is to a news organisation's credibility. Blair was caught fabricating and plagiarizing information in his news stories, which forced two editors to resign in order to salvage the publication's authority as a reliable news source. Large violations such as those committed by Blair seriously damage public trust in the media, but small errors in grammar, spelling and facts are more common and thus may have a more significant effect on the media's credibility (Paulson 2003).

The main way that journalists ensure that the news they produce is accurate is by checking, or verifying, the information or facts in their stories against one or more independent accounts. Some facts can be accepted as 'true', and so determining whether verification is necessary is situationally determined, depending on whether a claim is potentially libellous, what the potential political and social ramifications are, how powerful the people involved with any allegations are and whether the facts go against common sense (Tuchman 1972; Tuchman 1978; Ericson et al. 1987).

Verifying facts is one of the most important rituals of objectivity, because it adds authority and credibility to a news story by assuring the audience that the statements and information in the account are indeed facts (Tuchman 1978). Attributing these facts to named sources also helps to establish the journalist's objectivity by stating that any opinions are the source's, not their own (Tidey 2002). It also ensures that the audience knows where the information came from and enables them to judge the source's credibility for themselves (Fuller 1996).

Returning to the Blair incident, one of the main criticisms of the *New York Times* editors responsible for Blair's work was that they allowed Blair to use anonymous sources without sufficient checks. This caused John Temple, the editor of *Rocky Mountain News* to make the bold announcement in a memo to staff on May 12, 2003 that there would be a change of policy in the publishing of *Times* reports in the *News* and that now "*New York Times* stories that use anonymous sources must be approved in advance" by *News* editors (Sparkman 2003). Temple also noted that the *News* discourages the use of anonymous sources "because the reader has no way to judge whether the source is reliable and/or whether the source is using the newspaper for his or her end." Jim Sparkman, producer of the website Cronwatch, calls this "an astonishing development, because it suggests that in a few short weeks, the *Times* has gone from being among the most trusted news purveyors on the planet to a publication viewed with suspicion by its peers" (Sparkman 2003).

Most textbooks and guidelines for journalists include rules on cross-checking facts or using more than one source to corroborate information (e.g. see The PressWise Trust 2002). Interestingly, the New Zealand Engineering, Printing and Manufacturing Union (EPMU) code of ethics (which applies to print journalists even though they are not in the title) does not explicitly discuss accuracy or verification, but the New Zealand Press Council Statement of Principles (1999) includes accuracy as its first principle (see www.presscouncil.org.nz/principles.htm).

Journalists may verify information by checking public records, private documents or by seeking corroboration from other sources (Fuller 1996). Publication or broadcast in other media may also constitute verification (Ericson 1998), although this is problematic because it can create the potential for gradual accumulation of errors along the "food chain" of media outlets (Wilson 2000). Sources are used most often for verification, because scrutinising documents or written records may require interpretive work that requires expertise in the subject and because quotes are a typical feature of most news (Ericson 1998). In addition, there is a widespread perception that 'good' reporting requires multiple sources (Rubin and Hendy 1977).

### 3.5.1. Verification in science news

Certain facts such as names, dates and statistics may be easy for journalists to double check, but other types of facts may be difficult or impossible to verify. Tuchman (1978, p. 89) says that 'nonverifiable facts' are ones that "could be verified in theory but not in practice – and certainly not in time for deadlines." Most scientific claims fall into this category of facts that cannot be easily verified, because the journalist usually does not have ready access to the original scientific data and also because the journalist is unlikely to have the expertise or time to analyse the data anyway (Dunwoody 1999). Thus, most journalists must rely on other scientific experts to verify the validity of claims (Tuchman 1972; Goodell 1987; Nelkin 1995).

However, previous studies have found that science stories commonly contain only one source. For example, Weiss and Singer (1988) found that most American journalists accepted scientists' statements at face value, only occasionally seeking out other scientists for comment. Nor is this reliance on single sources restricted to uncontroversial claims. Friedman *et al.* (1996) studied American media coverage of a controversy concerning the potential health risks associated with alar (a pesticide used by apple growers), and found that the majority of journalists still quoted only one or two sources.

Dunwoody (1999) claims that there has been a recent normative shift to obtaining multiple sources for science stories (for example, see Blum and Knudson 1997), particularly because journalists who once relied on the scientific peer review process to weed out bad science have been burned in the past by the system's failure (e.g. the claim that genetically engineered corn pollen posed a risk to monarch butterflies). However, in practice journalists still rely heavily on single sources. For example, Pellechia (1997) found that the number of supportive voices in science stories stayed the same from 1966-1990, although the number of critical voices increased over time.

Studies in other countries confirm that single-source stories are not just an American phenomenon. Van Trigt et al (1994) studied medical coverage in the Netherlands and found that only 38% of stories with identified sources contained more than one. Similarly, Eide and Ottosen (1994) report on a 1988 study of journalists in Norway which found that 20% of the journalists interviewed said they based their story only on a single oral source. In New Zealand, Bell (1994b) found that one-third of climate change stories were each based on a single press release.

It seems paradoxical that single-source stories are so common in science reporting considering that verification is a valued practice amongst journalists. Check (1987) suggests that producing one-source stories is one result of what he calls a "political model of reporting". The political model is important because journalism evolved around the reporting of politics. A key feature of this model is that because facts are often unavailable to support assertions, the journalist must "appeal to authority" (Check 1987, p. 988). Thus, source credentials are one of the main ways that journalists evaluate scientific claims (Rowan 1989). This model discourages investigative reporting, because it dictates that journalists should rely on established spokespersons and that little follow-up or verification is necessary.

Time constraints may also force journalists to rely on single sources. Dunwoody (1980) found that journalists under strict deadlines or with more stories to write were more likely to write single-source stories than journalists with fewer constraints. In addition, Friedman (1986) suggests that reporters often rely on single sources because they do not know where to find additional scientific sources.

### 3.5.2. Consequences of not verifying scientific claims

A lack of verification may result in a number of problems for science reporting: 1) it may make new and preliminary scientific claims appear more certain than they are; 2) it may enable public relations companies and industries to manipulate the media to serve their own ends; 3) it may mean that stories may be accurate according to their sources but fail to be factually correct; and 4) it may make it possible for maverick or fringe scientists to present their claims as uncontested.

First, Check (1987, p. 990) believes that "the problem arises from accepting statements and interpretations by a single perceived authority rather than realising that where preliminary data and complex issues are involved, experts may be influenced by their own biases." In other words, single-source stories may make new and uncertain scientific claims appear more certain than they are (Stocking 1999). For example, reporting about newly developed medical products and techniques before they have been adequately tested may raise false public hopes and even alter people's behaviour

(Nelkin 1995). Moreover, if and when alternative views do eventually emerge, they generate public scepticism because of the perception that scientists cannot agree or are always changing their minds (Stocking 1999; Zehr 1999).

The most widely cited case of such reporting in New Zealand was the 1999 media coverage of Lyprinol, a mussel extract that was an alleged “cure” for cancer. The company developing the product produced a press release, and despite the obvious vested interests involved and the fact that no animal trials had yet been conducted, several news organizations reported the claim without any assessment by independent scientists or physicians (Comrie 2000). Physicians and other medical professionals were outraged as members of the public gave up their prescribed cancer treatments for the Lyprinol “miracle cure”. TVNZ was subsequently reprimanded by the Broadcasting Standards Authority for inaccurate coverage.

Lyprinol also illustrates a second problem that can arise when journalists fail to verify scientific claims: public relations companies and industries may be able to manipulate the media to a greater extent (see Coddington 1999, for further explanation of how the company producing Lyprinol manipulated the media in this case). Hager and Burton (1999) claim that PR campaigns are becoming more widespread, possibly because of cost-cutting and increased pressure for advertising, which mean that journalists have less time to spend on stories and must rely more heavily on single "expert" sources.

Third, single-source stories are problematic because they are based on the premise that accuracy means ensuring that what sources say is reported accurately, rather than seeking out what Lambeth (1992, p. 25) calls the "larger truths behind the facts". Thus, news stories may be accurate according to sources, but they may fail to be factually correct. When journalists simply report claims without verifying them, they become passive recipients of information, rather than seeing themselves as the active constructors of news that they really are (Shoemaker and Reese 1996; Mindich 1998; Kovach and Rosenstiel 2001). Thus, they abdicate responsibility for the coverage that they produce or the consequences that it generates (Roshco 1975; Glasser and Ettema 1989).

Finally, single-source stories can be problematic because they may give validity to claims by fringe or maverick scientists, whose views are not supported by the majority of the scientific community (Dearing 1995; Smith 1996; Dunwoody 1999; Stocking 1999). Dearing (1995, p. 343) defines maverick science as "unorthodox scientific theory which is believed as credible by only one or a few scientists." The scientific community tends to see theories with few supporters as unlikely to be supported by empirical evidence (Dearing 1995), and although maverick scientists may be right and may lead to radical paradigm shifts, the chance is small. As Dearing (1995, p. 344) states, "Disbelief does not falsify the theory or make its validation impossible, yet disbelief is an indication to journalists that the theory in question is considered by most scientists to be very unlikely to be supported."

Yet the media may report maverick science because often the scientists they quote are not necessarily those with the most relevant experience or qualifications, but rather those who are most accessible, vocal and quotable. For example, Smith (1996) found that when a self-trained climatologist with no formal qualifications predicted a severe earthquake, most journalists uncritically reported this claim for six months. When the United States Geological Survey released a report that refuted the prediction, journalists also uncritically covered that claim.

Another widely cited example is the cold fusion case, where in 1989, two scientists at the University of Utah announced they had achieved room-temperature hydrogen fusion. Despite the enormity of the claim, many news organisations reported the finding without seeking independent confirmation, because it was a novel, dramatic discovery that journalists knew would make front-page news for their competitors (Nelkin 1995; Dunwoody 1999).

## 3.6. Balance

While single-source stories may be the norm for science reporting, sometimes journalists are faced with conflicting scientific truth claims that require a different strategy. Typically, when journalists are confronted with conflicting opinions from sources, they respond by balancing those claims against each other and leaving it up to the reader to decide who is right (Dearing 1995; Nelkin 1995; Dunwoody 1999). Frequently, this approach pits "duelling scientists" against each other, which can overemphasise the controversy between scientists (Efron 1985; Burnham 1987; Dearing 1995; Nelkin 1995).

We saw in the previous section that verification is the primary way that journalists ensure accuracy, which is one facet of Westerstahl's model of objectivity (see Fig. 4.1). Balance is also part of Westerstahl's model, but whereas verification ensures factuality, balance ensures impartiality (Westerstahl 1983). Both verification and balance are also "strategic routines" or "rules" that journalists employ to assert their objectivity (Tuchman 1972). The balancing strategy is useful to journalists because if they cannot check the validity of competing claims, they can present all views fairly and leave it to their audience to judge the claims for themselves. The journalists thereby "absolve themselves of responsibility by structuring the alternatives" (Tuchman 1978, p. 91). Balance also serves other purposes, such as adding drama and news value to the event (Hall et al. 1978).

Balance has been variously interpreted as giving equal space or time to both sides, giving equal access to both sides, or simply getting the "other side of the story" (Dearing 1995). Print media are generally required to present alternative views within each story, but balance rules are applied to broadcast coverage over time, so that one view may be aired one day and an alternative view the next. One of the statutory requirements of the Broadcasting Act 1989 is:

> The principle that, when controversial issues of public importance are discussed, reasonable efforts are made, or reasonable opportunities are given, to present significant points of view either in the same programme or in other programmes within the period of current interest. (Broadcasting Standards Authority; www.bsa.govt.nz)

Balance is increasingly interpreted by regulatory agencies as 'fairness' rather than strict neutrality (Weigold 2001). For example, in one recent case Britain's television watchdog, the Independent Television Commission (ITC), received 116 complaints about a documentary produced by John Pilger called "Palestine is still the issue", which claimed that Israelis treated Palestinians unfairly and that this conflict lay at the root of the Middle East conflict. The ITC decided that the show was not biased or inaccurate, stating that balance was a flexible concept:

> It does not mean that 'balance' is required in any simple mathematical sense or that equal time must be given to each opposing point of view. It does mean that programme makers can come at subject matter from particular directions so long as facts are respected and opposing viewpoints represented (quoted in Ansley 2003).

Balance is another aspect of Check's "political model of reporting", which developed from a need to fairly present opposing political viewpoints (Check 1987). However, while it may be effective for politics, balance is not always an appropriate strategy for presenting science. While two opposing political views can both be valid, in theory only one of two opposing scientific views will be valid, although we may not yet be certain which one. Rowan (1999) argues that conflicting scientific findings cannot be reported in the same way as other disagreements, because science is based on empirical evidence. She suggests that science is unique in the sense that it emerges through the continual testing of claims and building support for one hypothesis over others.

### 3.6.1. Problems with balance in science reporting

The balancing strategy may create several problems for news audiences: 1) it does not encourage journalists to critically assess the validity of competing claims for audiences; 2) as a result, journalists may not provide enough information to enable audiences to decide which claims are likely to be true; 3) balance can make claims appear more uncertain than they are (c.f. verification, which tends to make new and preliminary claims appear more certain than they are); 4) it distorts the way that the scientific process works; and 5) it may enable maverick science to gain recognition disproportionate to the evidence that supports it.

First, while the balancing strategy may present readers with all of the potential options to a claim, Dunwoody (1999, p. 71) believes that this strategy encourages journalists "to leave their own analytical skills at home and to concentrate, instead, on conveying what they see and hear." As a result, journalists who use the balancing strategy just present alternative views with no analysis of the ideological basis, vested interests or empirical evidence on which those claims are based (Durham 1998). For example, Dearing (1995) found that even though a group of American journalists did not believe maverick scientists' claims, they still wrote stories that were uncritical of the maverick position.

In the eyes of the audience, balance may legitimise any point of view that is presented, regardless of how well-accepted it is by science or society, because it suggests that the competing claims are equally likely to be true (Dearing 1995; Rogers 1999). Moreover, the balancing of contradictory claims also either implicitly or explicitly asserts that the 'truth' lies somewhere in the middle of the two claims (Epstein 1974; Hackett 1984). Thus, the journalist may seek out extreme, polarised positions so that they can claim the middle ground (Dunwoody 1993; Rosen 1993).

Moreover, balance does nothing to help the audience decide which claims are true, which are false and which require further testing (Dunwoody 1999). For example, Wartenberg and Greenberg (1992) studied media coverage of electromagnetic fields (EMFs) and found that journalists did not analyse the quality of the epidemiological studies, nor did they explain the studies' limitations or what further research was needed. As a result, "readers are given the bottom line, from different points of view, but little information from which to assess the reliability of those views or the process by which those views have developed" (Wartenberg and Greenberg 1992, p. 391).

Balance may in fact send the message that the claim is more uncertain than scientists believe it to be (Stocking 1999; Zehr 1999). Zehr (1999, p. 10) suggests that this is because scientists and non-scientists have different understandings of what conflicting scientific opinions mean:

> In the scientific community, the implied uncertainty of these positions may be understood as a product of different assumptions, methodological approaches, or topic areas. However, in the more limited space of public science, this tacit knowledge may be left out, leading to an appearance of contradictory claims.

Thus, particularly in stories involving risk, balance may leave the audience uncertain about whether they should be worried and whether they should take precautionary action against the potential risks (Dearing 1995). The result, as Burnham (1991, p. 40) sees it is that "the public learns not science, but that there are competing [scientific] figures speaking on one side or the other, each trying to establish the most convincing authority and media presence." In other words, presenting issues as black and white battles not only distorts the issue, it also forfeits the opportunity to show the public how science works through the gradual gathering of scientific facts and the building of consensus opinions (Check 1987).

A final problem with balance in scientific reporting is that sources can use this routine to further their own agendas (Stallings 1990; Dunwoody and Griffin 1993; Nelkin 1995; Dunwoody 1999). Thus, like the failure to verify scientific claims, the balancing strategy may enable maverick scientists to gain undue attention and recognition. Two widely cited examples of how the media balance maverick science against mainstream views are global climate change (for example, see Nelkin 1995; Gelbspan 1997; Rowan 1999; Kovach and Rosenstiel 2001) and research into the risks of smoking. In the case of smoking, the American media used to report on one hand the Tobacco Institute and scientists working for tobacco companies, saying that smoking is fine and that it actually improves your health, and on the other hand the American Cancer Society and non-industry scientists, saying that smoking causes cancer and other life threatening illnesses (Miller 1992). This balance was maintained despite the obvious vested interests that the Tobacco Institute and industry scientists had in promoting smoking (Rosen 1993) and the fact that almost all non-industry scientists did not believe them.

Similarly, with climate change, much of the media coverage has pitted a few dissenters who dismiss claims of anthropogenic climate change, against the Intergovernmental Panel on Climate Change (IPCC), a group that represents the peer reviewed opinions of over 2,000 scientists from 120 countries (Starr 2002). As in the tobacco case, many of the fringe scientists who debunk climate change are also funded by industry and so have vested interests (Wilkins 1993; Starr 2002). Wilson (2000, p. 11) points out that much of this coverage has exaggerated the scientific debate about climate change, and he suggests that with issues such as climate change, "reporters need to be cognizant of the weight of scientific evidence."

Many journalists argue that dissenting groups or mavericks have a right to have a voice in the media alongside mainstream views (Reed 2001). However, several authors suggest that the problem is not that mavericks should not be heard, but that their claims need to be placed within a wider context so that the audience can interpret their overall significance and support (Dearing 1995; Boffey et al. 1999). Dearing (1995, p. 357) believes:

> Aligning media portrayals of maverick science more closely to how the majority of relevant experts consider that science is a strategy which reduces the range of error which mass media journalists may commit in communicating risk, while placing more of a burden on the scientific establishment to be correct and fair in its consideration of maverick theories.

However, even if journalists place maverick views in the context of the scientific consensus, the public may still be likely to support mavericks over mainstream scientists. Mavericks are often viewed as the "underdog" and their descriptions of scientific risks may align closely with public perceptions of those risks. Moreover, non-experts ("people on the street") are often used to bolster the maverick's case and the audience may readily identify with these sources. Thus, Dearing (1995) believes that expert testimony in such cases may be unlikely to dissuade the audience from believing the maverick.

### 3.6.2. An alternative strategy: the weight of evidence

An alternative approach to the balancing strategy is to present readers with some analysis of the overall evidence that supports or refutes the scientific claim. This "weight of evidence" approach is advocated by some science communication experts, who claim that conflicting scientific findings and opinions cannot be reported in the same way that other disagreements are reported (e.g. Dunwoody 1999). Science is unique because it emerges through the continual testing of claims and building of support for one hypothesis over others (Rowan 1999).

One way that journalists can use a weight of evidence approach for issues such as climate change is to inform the audience of the scientific consensus. Rowan (1999) suggests that it may be important for the audience to know how widely a scientific claim is supported within the scientific community. Starr (2002, p. 38) notes that "the majority opinion might not always be right, but it is important to state where the consensus of scientific opinion lies and reveal the sources of support of the various opinion-makers."

The alternative is for the journalist to actually evaluate the strength of the empirical evidence themselves. This may be difficult in cases where scientists hold different interpretations of the data. However, the scientific peer review process may help to some extent, and journalists may be able to do some basic analysis that would lead them to discredit at least the most outrageous maverick claims. Griffin (1999, p. 227) suggests that:

> One of the best ways for a journalist to discover whether scientific-sounding claims are valid is to subject them to the rigors of systematic thinking, that is, to the rules of evidence and reasoning scientists routinely apply to their investigations. Systematic thinking does not require journalists to be experts in research methodology and mathematics, although some basic knowledge of scientific procedures and statistics is certainly helpful.

## 3.7. Corngate: An example of verification and balance gone bad

The next section illustrates how verification and balance influenced the coverage of a specific scientific claim by the New Zealand media. This case, called "Corngate" by the media, re-kindled a debate that began several years earlier with Lyprinol over the importance of verification in media coverage of scientific claims.

Corngate began with the release of a controversial book called *Seeds of Distrust* on July 10, 2002. The book's author, Nicky Hager, alleged that the Labour Government had covered up scientific tests that showed that genetically engineered corn seed had been illegally imported into New Zealand in 1999. I examine the media coverage of these allegations in detail to show how a lack of verification plus the balancing of conflicting claims can be problematic for both scientists and news audiences.

### 3.7.1. Background

On the basis of media accounts and documents in the public domain, I pieced together the following picture of the Corngate incident. On October 10, 2000, 5.6 tonnes of sweet corn seed (40 million seeds) was imported from southern Idaho into New Zealand by food producer Novartis (now called Syngenta). The corn seed was sent to four distributors in New Zealand: Talley's, Heinz Watties, Cedenco and a South Canterbury distributor called Seed Production. The batch had tested negative for genetically engineered (GE) content before leaving the United States, but when Cedenco did routine tests of the corn seed in New Zealand in November 2000, it got back a positive test for a GE gene fragment called "nos". The introduction of GE seeds into New Zealand is illegal under the Hazardous Substances and New Organisms Act 1996, which prohibits the possession or release of genetically modified organisms (including seeds) without approval from the Environmental Risk Management Authority (ERMA).

Cedenco reported its concerns to the Environment Minister, Marian Hobbs, on November 13, 2000, by which time many of the seeds had already been planted: 1257 kg of seed over 93.7 ha in Gisborne, 381 kg over 27.7 ha in Hawke's Bay and 845 kg over 57 ha around Seddon in the Marlborough district. Over half of the seed was still waiting to be planted, including 1000 kg supplied to a wholesaler in Timaru.

Initial concerns suggested as much as 0.5% of the corn was GE contaminated – or about 200,000 seeds. Subsequent tests were conducted on 49,000 seeds in three laboratories (Crop & Food Research, GeneScan Australia and a United States lab), and they showed mixed results. In a report on December 4, 2000, Donald Hannah, the manager of science and research for ERMA, suggested that the GE seed was unevenly spread but was overall probably about 0.04% of the seeds, or about 15,000 plants.

The New Zealand Government initially wanted the seed destroyed, but sometime in December 2000 or January 2001, it developed an interim, voluntary protocol to allow 0.5% of seed imports to be genetically modified. On January 19, 2001, ERMA and the Ministry for Agriculture and Forestry (MAF) signed a joint draft protocol agreeing to "implement a testing regime for seed imports aimed at giving a 99% confidence that there is not greater than 0.5% contamination." This protocol made the existing shipment of corn seed legal and obviated the need to remove the potentially GE-contaminated corn that had already been planted.

Environment Minister Marian Hobbs released news of the GE "scare" and the proposed legislative change to the media in a December 19, 2000 press release, but Hobbs gave few details about the incident and did not reveal that some of the seed in question had already been planted (see press release in Hager 2002, p.141). Thus, news of the seed scare was largely ignored until July 2001, when Nicky Hager's book called *Seeds of Distrust* alleged that the Government attempted to cover-up the importation of GE corn seed by introducing a 0.5% tolerance limit to enable the corn to stay in the ground. The book was released just a week before the 2002 election, and thus the claims had substantial political implications.

Hager argued that the Government, under pressure from the seed industry, developed an illegal policy of "tolerance" for small amounts of GE contamination that misled the public and the Royal Commission on Genetic Modification that was convened at the time (Hager 2002). Hager's claims were based on leaked government documents, including Donald Hannah's December 2000 report that suggested the corn seed was contaminated with GE material at a low level. The documents also included a confidential memo from January 15, 2001 from ERMA's deputy chair and ERMA board member Dr. Lindie Nelson concluding that between 14,000 and 175,000 GE corn plants might have been planted out and expressing concern at the new Government acceptance of low levels of GE material:

> We are concerned at the apparent absence of any ex ante in-depth risk analysis to support the 0.5% acceptance level. Moreover, that this contamination level may be construed as being 'GE-free'...The Authority has been very cautious in its approvals of field trial containment applications. We have agonised over the risks of very small pollen escapes and how we could prevent these. It is ironic to find that Cabinet and officials are taking a less cautious approach to a release decision (document in Hager 2002, p.146).

The Government dismissed Hager's claims outright, suggesting that he had confused a "tolerance" level with what was actually a new "threshold" for testing for GE content (there was no established testing limit previously). Prime Minister Helen Clark and various ministers argued that scientific testing for GE content could not give 100% guarantees, because every seed would have to be tested to ensure a "zero tolerance". Thus, they said it was more appropriate to talk about "no detectable presence" and that the Government was trying to establish a testing system that would give them 99% confidence in detecting GE content of 0.5% or more.

It is difficult to know for sure whether the Government had a tolerance or threshold limit in mind at the time the interim protocol was being developed. However, it is clear that there was a great deal of confusion within the Government itself about exactly what was being proposed. For example, an email between two unnamed officials on January 25, 2001 says, “I was always worried people were talking past each other. There is no doubt that the interim protocol is completely illegal.” Likewise, Barry Carbon, Chief Executive of Ministry for the Environment for 8.5 days when Hager’s book was released, said at a press conference on July 11, 2002: “I believe there was a significant period when the word ‘tolerance’ was being used interchangeably with ‘confidence’ or ‘statistical variation’.” He also said that there was a group of people within Government advocating tolerance, but that this discussion was not relevant because luckily no GE contamination was found in this case. The protocol was revised in February or March 2001 to remove any explicit mention of tolerance.

### 3.7.2. Media coverage of Corngate

#### *3.7.2.1. Before the book release*

Various journalists received an advance copy of some or all of Hager’s book (one journalist read parts of the book as early as three weeks before its release). However, Hager says that he asked the journalists to refrain from discussing the book with other sources to protect against political meddling in the book’s release (N. Hager, pers. comm., June 2003).

On 9 July, the day before Hager’s book was released, journalists were busy preparing for the media bonanza that was to follow. John Campbell (TV3) taped a controversial interview with the Prime Minister, Helen Clark, that was to air the following evening after the book’s release. Clark claims she was not informed of the book or its allegations – or even the topic of the interview – either before or during the interview. This secrecy was presumably because of Hager’s embargo, but also probably because Campbell and TV3 hoped to illicit a more “revealing” response than they would have gotten if Clark had time to prepare (Atkinson 2003). This interview is currently under formal complaint to the Broadcasting Standards Authority (BSA) on grounds of lack of balance and fairness.

In addition, on July 9 the *Marlborough Express* interviewed the Environment Minister, Marian Hobbs, and various interviews were conducted with Hager (e.g. National Radio and the Auckland radio station 95bFM).

*3.7.2.2. Day 1, July 10: The official book release*

Table 3.1 (see end of the chapter) shows the headlines of the media coverage of Hager's allegations from 10 - 27 July. On 10 July, *Seeds of Distrust* was officially released early in the morning. The story broke on National Radio's morning news show Morning Report, which was then followed up with a pre-recorded interview with Hager in its Nine to Noon show. Several newspapers also ran stories, including a "background" piece in the *Marlborough Express* explaining Hager's allegations in detail and "straight" news pieces in the *Marlborough Express* and the *Waikato Times*.

The Government did not comment on the book and Hager's claims for a notable six hours. Then in the afternoon the Prime Minister, Helen Clark, held a press conference (mostly reported by the press the following day), saying that "The government states on the record that there was no cover-up nor is there any evidence of the alleged 'large-scale environmental release'."

That evening, TV3 ran a Special Report on Hager's claims featuring the taped interview from the previous day with Clark, preceded by an 11-minute feature based on Hager's book. Clark also appeared (live) on the TV ONE current affairs show Holmes that ran concurrently with the TV3 Special Report, during which she reiterated her claims that no cover-up – or even GE release – had occurred.

Apart from this "breaking" coverage, the media initially covered the story on July 10 by focusing on two angles. First, they focused on the food industry's response to the claims. The companies involved (Talleys, Heinz-Watties and Cedenco) denied any contamination had occurred. Likewise, the Federated Farmers organisation and growers groups said that they were satisfied that there was no GE contamination. On the other side, the organics industry called for further checks into the case, citing concerns about New Zealand's international reputation and its potential implications for the organics (GE-free) export market. The media also reported responses from lobby groups such as the Life Sciences Network (a pro-GE lobby group) and the Soil and Health Association (an organics lobby group).

The second angle that initial media coverage took was Helen Clark's "outrage" at both Hager's allegations and at John Campbell's "ambush" interview tactics. Thus, the media sought out responses from other political parties, especially the Green Party, and from political scientists. They asked whether the allegations might tarnish Clark's reputation, and how it might affect a potential coalition between the Labour and Green parties after the election.

Perhaps surprisingly, given the nature and severity of the claims, no scientists were quoted on July 10. The media were too busy asking whether there was a Government cover-up to focus on whether or not GE corn seed had indeed been imported and planted.

*3.7.2.3. Day 2, July 11: Scientists come forward*

The following day, 11 July, Hager's claims of a Government cover-up, almost instantly dubbed "Corngate", were splashed across the front pages of newspapers around the country. The coverage continued to be dominated by the same two angles covered initially: responses from the seed and agricultural industries and lobby groups, and the implications of the affair for the upcoming election.

By this time, a number of different sources had come forward or were sought out to comment on the claim, including politicians from all of the major political parties, spokespersons from the industry (e.g. seed companies) and various lobby groups from both sides (e.g. Federated Farmers, Life Sciences Network, Greenpeace, ECO). Their claims and counter-claims provided abundant material for the media to provide a "balanced" (i.e. two-sided) political account of the situation. For example, Hager's accusations were countered by Labour politicians who contested that there was no cover-up. Alarm from organic farmers, the Green Party and environmental lobby groups were likewise balanced with reassurances by industry and pro-GE lobby groups.

The first scientist to be quoted in the media on July 11 was Dr. Mike Berridge, the President of the New Zealand Association of Scientists (NZAS). (Berridge works as a scientist for the Malaghan Institute which is a member of the pro-GM Life Sciences Network and which has received funding from Novartis.) Like other interest groups, the NZAS had released a press statement on 10 July denouncing Hager's claims. On TV ONE's Midday news bulletin on 11 July, Berridge said that it is impossible to have 100% guarantees that GE seeds are not present. Berridge did not feature in other media stories that day, perhaps because other scientists that came forward at the same time captured the media's attention.

During the day, Barry Carbon, who had been Chief Executive of the Ministry for the Environment (MfE) for 8.5 days at that stage, and Dr. Basil Walker, CEO of the Environmental Risk Management Authority (ERMA), gave a press briefing. Carbon said that Hager's information was "essentially accurate" but that he disagreed with his conclusions. He also said that there was disagreement among the bureaucracy about whether to accept low levels of contamination, and that some politicians had advocated a legal change toward acceptance but that this was never adopted. TVNZ's ONE News (as well as the NZPA and TV3) covered Carbon and Walker's press briefing that evening, suggesting that "officials say we'll never know whether GE corn was planted here."

ONE News also ran a story that evening looking more closely at the testing process for GE. It quoted Dr. Gail Timmerman-Vaughan, a scientist at Crop & Food Research (the lab that tested some of the corn seed for Cedenco) saying that "our test result on the corn sample gave us positive for one of the tests that we test for and a negative for the other test that we test for," which they said meant that the test results were inconclusive. ONE News also briefly quoted Dr. Dick Bellamy, Dean of Science at the University of Auckland, who said that GE testing was limited by the sample size, which had to be big enough to be representative but could not be too big to require testing of all the seeds. Neither of the scientists gave further comment on the claims in Hager's book.

In addition, on July 11 Dr. Russell Poulter, a geneticist at the University of Otago who was contracted by Heinz-Watties to provide an independent review of the test results, released a press statement refuting Hager's claims. TV3 mentioned Dr. Poulter for the first time in its evening news bulletin. The Holmes show on TV ONE also interviewed Poulter, suggesting that "three genetic scientists [Poulter, Walker and Carbon] that we have spoken to today say that Nicky Hager simply doesn't understand the scientific testing and has drawn the wrong conclusions. Each of those scientists says they are thoroughly familiar with the testing processes for genetically modified organisms in food."

TV ONE did a further interview with Poulter on its 11 pm news bulletin, Late Edition, saying:

> Concern over claims of a cover-up quickly changed to the question of whether GE corn was planted here...Today a bevy of scientists said effectively, no, there was no contaminated corn, or at least tests showed it was highly unlikely there was any contaminated corn.

In particular, Poulter discussed a Crop & Food Research press release issued that day which raised the possibility that its first positive test results were due to soil or talcum contamination of the seed sample. Poulter suggested that this was the "missing piece of the puzzle" and the "smoking gun" to explain the mixed test results.

Thus, by the end of July 11, the media seemed to have concluded that the scientific consensus was that no GE corn was released. This was largely based on the comments of one research scientist (Poulter) and two science managers (Walker and Carbon) who were either personally involved or who represented institutions involved in the affair. All three of them also came forward themselves to discount Hager's claims, rather than being sought out by the media. TV ONE questioned Poulter about his involvement in the affair and whether he was truly an "independent" expert, but did not go beyond this to try to identify scientists who were not involved at all to independently assess the claims. The only scientists quoted in the media who were not involved in the actual affair, Bellamy and Berridge, were only quoted briefly and were only asked general questions about testing for GE seeds.

*3.7.2.4. Day 3, July 12: And still no independent verification...*

On July 12, the third day into Corngate, the print media largely followed the stories advanced by television the night before, especially Carbon and Walker's press briefing. However, NZPA and TV3 chose a very different angle from the previous night's television coverage of the briefing, suggesting that Carbon and Walker's statements did not rule out GE contamination (e.g. "Officials believed NZ was headed for a GE-tolerant regime" and "GE contamination not ruled out – ERMA" from NZPA).

One NZPA story quoted Carbon as saying, "I believe there was a significant period when the word 'tolerance' was being used interchangeably with 'confidence' or 'statistical variation' and...quite a few of them were inappropriate." Carbon went on to say that there was a group of people in the Government advocating tolerance but luckily no contamination was found so this discussion was not relevant.

Another story said that "...it emerged that the scientific tests ordered by the Government did not completely rule out GE contamination" and quoted Dr. Walker as saying, "The conclusion we reached was that based on all the information available, we could not conclude that there was a reasonable case for requiring the crop to be pulled up. At no stage have we said, categorically, that there was no contamination." TV3 also used this quote from Walker, suggesting that Walker "broke the party line" by saying that there may have been small amounts of GE contamination. That night on National Radio's 5pm news show, Checkpoint, Mary Wilson conducted a forceful interview with Walker that also suggested that the Government had something to hide.

Meanwhile, a number of newspapers followed up on Poulter's claim on the Holmes show on July 11 that soil contamination was the "missing piece" needed to explain the mixed test results. The *Otago Daily Times* suggested that this "new evidence" provided the "final piece of the puzzle". The *Dominion Post* said, "Dr. Poulter and others suspected the test result was an anomaly at the time, but could not prove it." *The Press* asked Dr. Timmerman-Vaughan to comment on the "new evidence", and her response was that "this shifts the probability towards it being dirt rather than GE." The *New Zealand Herald* explained:

> In a new revelation, the Herald learned yesterday that a bag of soiled corn seeds returned by a Gisborne farmer seeking a refund might be behind the GE scare...He (Poulter) had been puzzled that the positive test result had shown a genetic sequence with a terminator signal which was frequently found in transgenic corn, but had shown no sign of a promoter signal.

All of these pieces treated the soil contamination as if it was a new finding that suddenly had been discovered, but in fact, the probability of soil contamination had been noted soon after the initial positive results were found. In Donald Hannah's original December 2000 report, he stated clearly that some of the samples were from an open bags and that soil contamination was a possibility. Why then did the media report it as the "missing piece of the puzzle" that had finally come to light?

This is another example of how the media simply reported their sources' claims without any verification or attempt to understand the basis for the claims. The reason that the soil contamination issue arose on July 12 is that Crop & Food Research released a press statement on July 11 stating:

> The sample that tested positive (Jubilee NC9114) was one of eight samples submitted for testing. Only the Jubilee sample returned positive PCR tests. Subsequently the origin of this sample was found to include a bag of seed which had been returned by the farmer. The bag had talcum powder added to it, to make the seed flow better through the drill. The presence of the talcum powder indicated that seed had been removed from the bag, therefore introducing the opportunity for soil and soil bacteria to contaminate the sample. This meant that the positive test could have arisen from several sources of sample contamination while the seed was outside the bag. Contamination with soil and soil bacteria could account for the positive "nos" sequence result.

Nowhere does Crop & Food Research mention that the possibility of soil or talcum contamination was a new development. The media almost entirely ignored this press release, but the day the statement was released (July 11), Russell Poulter appeared on the Holmes show and he referred to the contamination mentioned in the statement as the "missing piece of the puzzle". From then on, the media discussed the soil contamination as though it was the discovery that scientists had been waiting for that finally explained results that had had scientists perplexed. In fact, all that had happened was that Crop & Food Research had stated its interpretation from its initial investigations – an interpretation that journalists could have had from the beginning had they gone to Crop & Food scientists for a response to Hager's claims earlier.

This example shows clearly that the media were relying on scientific sources to interpret the test results for them. If journalists had gone back to Hannah's original report, or even if they had read Crop & Food Research's press release carefully, they would have realised that the possibility of soil contamination had been recognised by scientists early on and that it wasn't a "new development" at all. However, journalists automatically accepted Poulter's interpretation of soil contamination as the "missing piece of the puzzle".

Apart from these stories, the media largely continued to focus on the same peripheral issues they had covered since the beginning: the response from various interested parties and the political effects of the allegations on the Government and the election campaign. In addition, the row between Clark and TV3 over John Campbell's initial interview received considerable coverage. Hager also received considerable time in a variety of media to rebut the Government's denials.

Yet, still, surprisingly few scientific voices were heard on the subject. The *New Zealand Herald* briefly quoted one additional scientist, Dr. Richard Gardner of Auckland University. The story said only that Gardner "agreed that testing for genetically modified corn could easily throw up false results." ONE News also interviewed another government scientist, Dr. Lindie Nelson, a board member of ERMA and one of the authors of a memo that expressed concerns over the proposed testing standards for GE. Nelson denied claims that she had aired concerns about the GE corn, saying, "My view is that following the discussions we had in February, I was very reassured that the evidence was that it was likely that there was no contamination or else it was insignificant."

The only other scientist that received media coverage was Dr. Mike Berridge, President of the New Zealand Association of Scientists, who had been quoted on July 11 following an NZAS press release. The *Otago Daily Times* quoted directly from this press release, saying that Berridge thought that Hager's claims had "no sound scientific basis" and that "this is yet another case of intuition and innuendo upstaging the scientific evidence, at great cost to this country."

At 7:42 pm on Friday, July 12, the Government finally released government documents regarding the claims, as it had promised to do for some time. This late release precluded most media coverage until the following day; the documents received only a cursory mention on TV3 that evening ("an initial reading does not provide a smoking gun to prove the Government is right…").

*3.7.2.5. July 13-15: The balancing act*

On Saturday, July 13, the *New Zealand Herald* took the lead in assessing the newly released Government documents, suggesting that the released papers showed disagreement and confusion amongst Government officials about how to deal with the GE scare. That evening, TV ONE took a different slant, saying that Carbon claimed the papers vindicated the Government and that he believed that Hager should apologise, although this was balanced with a statement from Hager saying that he stood by his original claims. TV3 took a neutral view, saying that the papers showed that officials called the issue "a political hot potato" but contained little evidence one way or the other.

On Sunday, July 14, NZPA produced a story suggesting that the Government papers did not appear to support Hager's claims and in fact showed that ripping the corn out would have cost the Government between $534,000 and $890,000. However, by Monday, July 15, most of the media were more critical, expressing doubts about whether all of the evidence had been adequately considered to dismiss Hager's claims. NZPA now suggested that the released papers showed that PR companies working for the seed industry had redrafted a Government press release about the incident, trying but failing to remove any mention of sweet corn. Another story on July 15 again mentioned the potential costs to the Government to rip out the corn, but also referred to "confusion over the definition of 'tolerance' versus 'confidence' levels." ONE News went so far as to say that "a decision not to rip out the suspect crops was made before all the test results were in…" and that "in the documents, officials admit that it is reasonably likely

GE-contaminated crops were accidentally grown." National Radio's Morning Report similarly said that the papers revealed "confusion and argument within Government".

Apart from these stories, though, most of the coverage continued to rehash old ground on the same peripheral issues (e.g. the clash between TV3 and Clark, reaction from the Green Party, calls for Hager to apologise). No new sources were introduced from those previously covered, with one notable exception. On July 15, Dr. Peter Wills, a theoretical biologist and the head of the physics department at the University of Auckland, came forward to refute Government claims that there was no GE contamination of the corn seed.

Wills released a press statement that was picked up by both TV ONE and TV3, suggesting that the released Government documents had "missed a key mark". ONE News quoted Wills as saying that "there was suspicion of contamination and that suspicion was never put to rest." His assertions were balanced with comment from Russell Poulter, who suggested that the tests conducted were simply not powerful enough to detect such tiny amounts of contamination: "It's like taking out your binoculars tonight, pointing them at Mars and saying I can see canals and little green men on gondolas on canals. The answer is your binoculars can't do that for you."

However, despite this introduction of what TV3 called a "new voice of doubt", despite continued confusion over exactly what the released government papers showed (and little in-depth analysis of them), and despite considerable uncertainty still about the truth of Hager's claims, coverage of Corngate suddenly lost its steam. The affair had lost its news value as a novel political issue and almost immediately, it dropped from the hard news. Just a few stories continued to discuss John Campbell's controversial interview with Helen Clark and the formal complaint laid by Clark against TV3, and a single story in the *Dominion Post* on July 16 picked up the NZPA story of July 15 about the claim that seed company PR people had influenced Government policy.

Perhaps more surprising than this lack of hard news, though, was the paucity of analytical feature coverage following up on the numerous unresolved issues related to the claims. On July 13, the *New Zealand Herald* ran a feature reviewing the story, but it provided no new information or sources or any substantial analysis of the scientific issues at stake. The science reporter at the *Herald* (who did not write this feature) only produced a profile piece on Nicky Hager, providing some background on this main character but again failing to provide any scientific analysis of the situation.

The most comprehensive analysis of the issue in the mainstream media was a feature on July 20 in *The Press* (Espiner 2002). Espiner asked, "So have we all eaten GE sweet corn?"; his answer: "It seems highly likely that some of us have." Thus, he openly evaluated the available evidence, but he did not introduce any new sources. There were also several features in the weekly magazine, the *New Zealand Listener* ("Planting the seeds of doubt" on July 20 and "Bad Seeds" on July 27) but again these mostly rehashed old arguments and contained little scientific analysis. In "Planting the seeds of doubt", Gordon Campbell came to a very definitive conclusion ("Thousands of GE plants have almost certainly been grown, harvested and eaten unwittingly by New Zealanders who were not warned – when they could have been – by the government."), but there is no evidence that he consulted any additional scientists besides those who had already come forward themselves. Likewise, in his follow-up story on July 27, Gordon Campbell still only quoted Poulter and Wills, in places verbatim from their press releases.

### 3.7.3. Verification in Corngate

Vicki Hyde, editor of the website SciTech Weekly and head of the New Zealand Skeptics, suggested on National Radio's Mediawatch programme (July 14) that one of the major problems with the coverage of Corngate was that Hager's claims were originally run as more definitive than they actually were, just as had happened in the case of Lyprinol. For example, the *Marlborough Express* on July 10 led with this statement:

> Thousands of corn plants from a shipment of GE contaminated seeds were grown in Marlborough last year with the Government and food companies covering up the secret. The dramatic and damning revelations were made this morning in a new book, *Seeds of Distrust*, by Wellington author and researcher Nicky Hager.

TV3 had an equally sensational lead on its Special Report that evening:

> On 10 October, 2000, a consignment of sweet corn seeds arrived by ship from the United States. In total, there was 5.6 tonnes of it, that's 7% of New Zealand's entire annual sweet corn crop. And what you've never been told is that the shipment was contaminated with genetically engineered seeds.

Despite these dramatic claims, though, all of the other leads on July 10 were much less certain, even the news stories in the *Marlborough Express* and on the TV3 evening news. This was probably because in this case – unlike the Lyprinol case – Hager's claims were clearly controversial. In presenting only one side, the media's objectivity was at stake – a point most journalists seemed to be well aware of. In fact, TV3 was criticised for its initial coverage for this very reason. An editorial on July 13 in the *Waikato Times* is illustrative, claiming, "Objectivity is becoming a victim of the media debate on GE. TV3's news special on the possible release of GE corn is a prime example of this problem."

Therefore, almost all news organisations attributed the claims to Hager and gave the Government and industries the chance to refute the claims from the beginning. For example, ONE News on July 10 led with: "This morning a new book went public with allegations of government secrecy over contaminated corn. Helen Clark and her officials were quick to dismiss them." It also ran responses from the food industry. Similarly, the TV3 evening news had a much less sensational headline than its Special Report that was to follow:

> A book published today claims the Government has hushed up a genetic engineering debacle. The book, written by environmental activist Nicky Hager, accuses Cabinet of concealing the accidental release into New Zealand fields of thousands of genetically engineered sweet corn plants. If he's right, those sweet corn plants could dish up a disaster at the polls, but Hager's claims are being strongly denied by Helen Clark and her ministers.

Thus, the problem with the Corngate coverage was not so much that journalists failed to report uncertainties or to balance the claims with comments from the 'other side'. Rather, the issue in this case was that the scientific validity of the claims was not independently verified with scientists. Over 60 sources were quoted in the cumulative Corngate coverage, but only nine of these sources were scientists. Moreover, only six of these scientists (Poulter, Timmerman-Vaughan, Gardner, Bellemy, Wills and Berridge) were actively involved in related research. Of these six, only Poulter, Timmerman-

Vaughan and Wills were quoted in the media regarding the validity of the specific test results in this case (Gardner, Bellemy and Berridge were only quoted on the general methods for testing seeds for GE content). Both Poulter and Timmerman-Vaughan had been involved in either the original testing or in the interpretation of the results for the Government and thus were not strictly speaking 'independent'. The remaining three scientists (Walker, Carbon and Nelson) were managers for science organisations and were primarily acting as public servants, not as independent scientific 'experts'.

Journalists, scientists and non-scientific news sources all recognised the lack of independent scientific verification as problematic. For example, a reporter stated in an editorial in the *Sunday Star-Times* on July 14 that "Campbell fell into the trap that has ensnared so many cub reporters: he got hold of an exciting document and treated it like Holy Writ." Russell Brown, commentator on 95bFM's *Hard News*, said on July 19, "I think if the news organisations that went out with the story had decided to seek independent scientific advice, this story would have emerged quite differently. The way it did emerge – dropped like a bomb on the election campaign – was simply wrong." Similarly, Prime Minister Helen Clark said, "That story should never have been run the way it was without journalists independently verifying the information" (Late Edition, July 12). Russell Poulter claimed, "It's irresponsible journalism in my view. You have to at least make the effort of listening to various perspectives. You can at the end if you want to say okay we're going to run with a particular spin on this but you have to at least go to the trouble to find out what the contesting views are."

In fact, no scientists entered the media coverage of the affair until the day after Hager's book was officially released, despite the fact that some journalists had been aware of the story for up to three weeks. Why was the media not more pro-active in seeking independent scientific advice in this case?

One reason seems to be that journalists' definition of verification did not require them to seek out independent scientists to review the claims. John Campbell told a group of University of Canterbury journalism students on September 2, 2002 that he verified Hager's claims, by which he meant that he had checked Hager's documentation to be sure it was authentic. Hager himself said he had independently verified his claims with scientists, but they were not willing to go on the record (N. Hager, pers. comm., June 2003). Thus, as Russell Brown concluded on National Radio's July 14 Mediawatch show, "TV3 did not conduct an investigation, Hager did. For TV3, an investigation would have entailed seeking independent scientific advice about Hager's conclusions about test results, which is backed in the book by unknown, unnamed experts."

A second reason that journalists failed to verify Hager's claims with scientists seems to have been that the affair was framed largely as a political issue rather than as a scientific one. Hager's claims emerged during the middle of an otherwise uneventful election campaign, and thus political reporters saw this as an important political development that could influence the election outcome. Thus, the issue of foremost interest was whether there had been a Government cover-up, not whether the tests had proved there was actually GE contamination. This is illustrated by the fact that the sources used during media coverage of Corngate included 16 politicians, 16 industry and farming representatives, six lobby groups and five political scientists – but only six research scientists.

As a result, journalists with science or environment rounds, who might have focused more closely on the scientific issues, were largely sidelined. One reporter who concentrates on science told me after the affair had ended:

> The coverage of Corngate was a touch schizophrenic, in the sense that it exploded in the middle of electioneering, and everywhere one went, there were political journalists (Parliamentary Press Gallery) and news directors (e.g. news editors and chief reporters) falling over themselves to treat it as a political story...Despite this, once people started talking about 'promoters', large chunks of the material were on-passed to me.

Indeed, once Carbon, Walker and Poulter spoke out, the media began to recognise that the affair was a scientific as well as political issue. On July 11, TV3's Stephen Parker hinted that scientific arguments were at heart of the issue: "I think what we're going to get here is an argument over the science, the science of who's right, what test is right, what test is wrong. It's a very complicated issue that's hard to cast judgements on." However, still no other scientists were called on to evaluate the evidence.

A third reason that may account for the lack of independent scientific verification in the Corngate case seems to have been that the media mainly got their information from press releases rather than by pro-actively seeking out sources. When the media did finally report comment from scientists, it appears that they did so only because scientists came forward themselves with press releases. The three scientists that were most widely quoted – Carbon, Walker and Poulter – released press briefings that sparked media interest.[5] In addition, the New Zealand Association of Scientists sent out a press release on July 11 quoting its President Dr. Mike Berridge, some of which was used verbatim in the ensuing coverage. Moreover, many of the non-scientific sources that were widely quoted by the media also had released press statements. For example, the lobby groups Greenpeace, ECO, Life Sciences Network and Federated Farmers all sent out press releases that were either quoted verbatim or followed up by reporters in further interviews.

There are several potential explanations for why journalists relied so heavily on press releases. First, journalists often rely on press releases when they have tight deadlines or other time limitations (Dunwoody 1980). In this case, Hager sent part of his book to some journalists before its official release, and so they should have had ample time to contact independent scientists for advice. However, it may have been difficult for them to take the test results to other scientists without revealing where the information had come from and thus breaking Hager's embargo. Still, Atkinson (2003, p. 7) argues, "Corngate was an historical event, not 'breaking news' in the conventional sense that the events in question were unfolding as the media were conducting their investigation. This makes TV3's failure to canvas independent scientific advice hard to explain away."

In addition, press releases may also be useful when journalists do not know who to go to for independent advice. It is possible that journalists in this case did not know who to go to with Hager's information, or that they went to scientists who were unwilling to speak out. There is no evidence to suggest that journalists went to scientists who were not

[5] Note also that two of these scientists were working as managers for science organisations, not active researchers in the field. Both Carbon and Walker had worked in managerial roles for some time.

eventually quoted, but Hager has argued that it is difficult to locate independent scientists in New Zealand. The small size of the country means that relatively few scientists have relevant expertise in specific areas and an increasing number have industry funding or research connections.

However, this excuse does not seem to hold much water given that other journalists eventually found scientists with whom to check the facts. Russell Brown, who produces the 95bFM Hard News show, explained how he checked out Russell Poulter's claims:

> I spent a bit of time this week making phone calls to [Poulter's] peers and to his head of department to find out what other scientists thought of Dr. Poulter. He is regarded as strong-willed and individualistic, a maverick even, but the endorsement of his competence in both the theory and the practical elements of testing was universal. A molecular biologist told me he believed Poulter was 'almost certainly correct' in his review of the test results…I also spent time seeking independent evidence of the science Poulter has cited in the past week – as much as a fairly bright lay person with good internet skills can, anyway. Everything checked out. (From Hard News, July 19, 2002)

Similarly, Steven Price, a freelance journalist and law lecturer wrote a story for *Metro* magazine in February 2003 that provided analysis of the Corngate affair and the numerous scientific arguments made (Price 2003). Price has no scientific background, and yet he spoke with a number of independent scientists who had not received previous press coverage including: Professor Charles Hurburgh, head of Iowa State University's Grain Quality Initiative, Dr. Geoff Rickards and Dr. Geoff Chambers of Victoria University's School of Biological Sciences, and Dr. Rob Lake of the Institute of Environmental Science and Research (ESR).

### 3.7.4. Balance in Corngate

The Corngate coverage also illustrates how balance can influence the reporting of a scientific claim. During the first few days of coverage before scientists came forward to dispute Hager's claims, other sources such as politicians, lobby groups and industry spokespersons were largely used to balance Hager's claims. For example, Helen Clark expressed "outrage" at the allegations of a cover-up, while the seed companies and growers associations remained "convinced" that no GE contamination had occurred. On the other side, organic farmers associations, environmental lobby groups and Green and National Party politicians supported Hager.

Nonetheless, even from the beginning the claims were framed as if the science behind the claims was all a matter of opinion. On July 10, the day that the book was released, TV ONE aired an interview with two politicians arguing about the results. Green Party co-leader, Jeanette Fitzsimons, argued that the book showed that five samples tested positive, while Science Minister Pete Hodgson argued that they were not positive results and that it was a misunderstanding. The reporter's response was, "It's obviously about which scientist you believe" (despite the fact that they had not actually talked to any scientists at all). Hodgson responded, "It most certainly is not. There is not going to be division within the scientific community of those who know about this as to what those results mean…Test it. Go to scientists and find out. It's about time someone did."

It is not surprising, then, that when Carbon, Walker and Poulter finally came forward to dispute Hager's claims, they were thrown into the mix just like everyone else. Sometimes, their comments were even used to balance each other; for example, Walker was said to have "broken the party line" by suggesting that the Government never categorically said that there was no GE contamination. Other times, they were simply balanced against the same lobby groups and politicians that had supported Hager all along. For example, on July 11, TV3 balanced excerpts of Carbon and Walker's press briefing with quotes from Hager saying he still stood by his book and Jeanette Fitzsimons saying that she was also still questioning the Government's actions. The TV3 reporter concluded that "I think what we're going to get here is an argument over the science, the science of who's right, what test is right, what test is wrong. It's a very complicated issue that's hard to cast judgements on."

The only scientific voice to balance the scientific arguments against Hager came when Professor Wills came forward to back Hager. Yet, still there was almost no analytical coverage or evaluation of the different arguments; rather the two scientific arguments could now be balanced against each other. For example, ONE News reported on July 13: "It seems that after four days, it still comes down to this, the same set of facts but a different interpretation and its unlikely the two sides will ever agree." Similarly, an editorial in the *Sunday Star-Times* on July 14 said, “Clearing up the technical argument will take time. Despite days of claims and counterclaims, it is difficult to be sure where the truth lies.”

Why did journalists balance these competing claims as if it was all a matter of opinion, rather than trying to understand which side was supported by more evidence, or even by more scientists? Partly, it seems that journalists were eager to seem ‘objective’ (in the sense of being fair to both sides), especially given the political implications of the claims. However, balance may also have been a preferred strategy because most of these journalists were political reporters who lacked a background in science and science reporting. At least 34 different journalists covered the affair (in addition to the coverage generated and widely circulated by the NZPA) and few of them followed the story from beginning until the end.

On the other hand, we already saw that several other journalists without science backgrounds (Russell Brown and Steven Price) wrote analytical pieces that attempted to assess the available scientific evidence. Brown told me:

> The science side of it was mostly a matter of noting the key elements of the science relating to the PCR tests in question and looking for verification of them. I was obviously in no position to say whether or not Poulter was ‘right’, but I set out to determine whether his assessment was scientifically viable – that it was a reasonable point of view.

Thus, limited science experience alone was probably not enough to prevent a weight of evidence approach, although it may have discouraged journalists from assessing the scientific claims. Again, Brown suggests, “Most media seem to be scared of the science and prefer to pursue GM issues through personalities.”

### 3.7.5. Results of these practices

Russell Brown has suggested that “there would certainly have been a story had TV3 and National Radio gone and got independent advice” but that “it just would have been a different one.” How might the story have been different if journalists had verified

Hager's claims with independent scientists and attempted to weigh the evidence for each side?

First, Hager's claims probably made more sensational headlines than they might have if independent verification had been sought from scientists. If some scientists from the beginning had disputed the fact that the test results showed GE contamination, the original story would have been weakened. Scientific arguments would have also distracted from the issue that most journalists were interested in: a cover-up and its potential impacts on the upcoming election. As it happened, the story without scientific comment made a highly newsworthy story about a political issue, not a scientific one.

The second result of the lack of independent verification and evaluation in this case was that the New Zealand public was presented with a high degree of uncertainty about the truth of the claims. When scientists came forward to refute Hager's claims, and then Wills came forward some days later to support Hager, the net result was the message that everything depended on "which scientist you believed" and that the science was essentially a matter of opinion. Few news pieces attempted to give people an overview of the evidence for each side to help them assess the probable validity of the claims and counterclaims.

The third major result of the Corngate coverage was that because the reporting was almost entirely reactive rather than investigative, it was relatively easy for sources to control the debate. The media were distracted by peripheral issues that seemed to be initiated by news sources, not by the journalists (e.g. Clark's "outrage" at the claims, the Green Party's involvement and response to the claims, the effects of the claims on the election and the relationship between Labour and the Greens). Similarly, journalists also mostly relied on press releases to identify for them what scientific issues were important. For example, a Crop & Food Research press release about soil contamination was largely ignored by the media until Dr. Russell Poulter called it "the missing piece of the puzzle" on the Holmes show (H. Bezar, Crop & Food Research, pers. comm.). After this comment, media across the country rushed to cover what Poulter had a framed as a 'new development', even though scientists had noted the possibility of soil contamination as early as December 2000.

Likewise, both government officials and scientists emphasised that both Hager and the media had not understood the nature of scientific testing. Various individuals argued that science cannot provide categorical assurances of GE-free seed without testing every single seed. Environment Minister Marian Hobbs called this confusion between a "threshold" and a "testing level". She suggested that there was no change in the tolerance level, only a new testing level set at 5 seeds in 1000, which gave them 99% confidence that no seeds in the sample were GE. A change in the testing level, as opposed to the threshold for GE, would not have been illegal.

Although scientists and the Government accused the media of ignoring this distinction between a threshold and a testing level, in fact this became a major focus of the media coverage of the affair. For example, in its first story about the affair on July 10, TV ONE explained, "A test to certify the corn 100% GE free would require testing every kernel of corn in the shipment." The next day, it reiterated this point, saying that in testing crop imports, "The term zero tolerance cannot apply…because it would imply that every kernel of corn had undergone PCR testing and passed. Instead, scientists use the phrase 'no detectable presence' meaning that no GE material was detected in the sample."

ONE News even did an entire story on why testing could not provide guarantees, saying that zero tolerance could only be met if every seed was tested. Reporter Lisa Glass ended the report by saying, "There's no such thing as an absolute scientific guarantee." Similarly, the media discussed the threshold versus testing limit distinction. In a feature on July 20, *The Press* explained:

> The crux of the argument is whether the Government was allowing a 'tolerance' for GE or merely stating a 'threshold' for testing. It is a vital distinction, as officials told the Government at the time. A tolerance implies up to 0.5% of a corn seed shipment can contain GE. A threshold implies GE is prohibited but testing can only be performed to a maximum reliability of 99.5%.

Thus, the media did spend considerable time, right from the beginning, explaining that scientific testing could not offer 100% GE-free guarantees and that testing limits were different from arbitrary tolerance thresholds for GE contamination. However, these explanations seemed to divert the media's attention from the fact that officials within Government had also been confused about this distinction at the time that the new 0.5% limit was being discussed. In fact, Barry Carbon himself said that there had been confusion within Government over the tolerance versus confidence issue. He claimed that Hobb's explanation that the 0.5% limit was a testing level was not sufficient given that PCR techniques can detect 0.01-0.1% contamination and that it was "just lucky" that the tests were inconclusive because otherwise contamination would have been interpreted based on tolerance levels.

The *New Zealand Herald* (July 13) explained this discrepancy in this way:

> Officials and scientists were trying to set a standard for tests, which would allow them to say they were 99% sure any contamination was less than 0.5%. The figure was based on the technical limits of the technology. A lower figure of 0.1% was supposedly rejected as theoretically achievable but not good enough in practice to support possible prosecutions. The Government's later decision to switch to a 0.1% standard starting from next month is explained as the result of improved testing technology.

Likewise, most media accepted the Government's explanation that the 0.5% limit had been a testing level rather than a threshold. More importantly, though, even those journalists who noted the confusion within Government over the distinction did not go beyond this to ask more about why this particular testing level had been implemented. Colin Espiner of *The Press* (July 20) was one of the few journalists to ask what limits determined this 0.5% level:

> Officials worked out that the problem with a 0.01 tolerance for GE was that 76,750 seeds would need to be tested from the current batch. Expensive and time-consuming. A 0.5% tolerance meant only 1532 seeds had to be tested.
>
> Referring to a media release by Hobbs outlining a new GE testing regime, ERMA said it implied 0.5% was the limit of testing capabilities. In reality, ERMA said, a stricter testing regime was perfectly feasible.

Gordon Campbell asked a similar question in his article on July 27 in the *New Zealand Listener*, quoting a memo from Dr. Basil Walker on January 30, 2001:

> We could very readily design the system to pick up a lower level of contamination – just increasing the sample size would move things in that direction. Anyone

with any knowledge of stats can calculate that for themselves – and they will!

Apart from these few, more probing pieces, though, news sources (either consciously or unconsciously) effectively steered the media away from these more difficult questions, thereby controlling the limits of the debate. Thus, the fact that the majority of the media did not try to independently verify Hager's claims with scientists may have meant that a number of more important questions were left largely unexplored. For example:

- How reliable was New Zealand's testing system? Was it capable of producing reliable results? Has it been improved since then?
- What factors (e.g. sample size) limited the detection level and could those factors have been altered to lower the detection level? If so, what would the costs have been?
- If there was some doubt about GE contamination, where should the burden of proof have been? If there was uncertainty, should the crops have been destroyed anyway? Did New Zealand law require a precautionary approach?
- Was there enough data in the public domain for scientists to judge the evidence for themselves? Was full disclosure needed so that scientists could fully scrutinize the results?
- Why wasn't re-testing done when the results were inconclusive?
- Why didn't the Government do its own tests rather than relying on companies with a vested interest in the results?

The degree of control that sources had in this case over setting the "media agenda" is particularly important because certain types of sources were more likely to get covered than others. For example, politicians and lobby groups were more likely to get covered than scientists. Also, sources who came forward themselves with press releases were more likely to get coverage, even though they were not necessarily the most qualified to comment.

## 3.8. Conclusions

This chapter has described how verification and balance arose as important journalistic practices out of the norm of objectivity. Other individual and organizational constraints reinforce the use of the balance strategy (e.g. individual journalists' lack of scientific background, strict time constraints), but in contrast, these constraints work against the practice of independent verification. Thus, journalists who have limited time or who are under pressure to produce novel, newsworthy stories may not check claims with independent scientists. On the other hand, journalists who are confronted with conflicting claims seem inclined to balance the claims rather than analysing which is supported by more evidence.

The case of Corngate illustrates how a lack of verification and the use of the balance strategy cause journalists to become passive transmitters of their sources' messages, rather than pro-actively investigating scientific issues. The result for science is that certain scientists will be more likely to have their views aired than others. Scientists in managerial positions, those who work for organisations with public information officers and those who are willing and able to come forward themselves will get coverage, even if they are not the experts with the most relevant knowledge and experience. The net result for news audiences is that they will be presented with a number of different claims and told that any of them may be right, but not given enough information to decide for themselves.

The next two chapters will take a step back and look at whether Lyprinol and Corngate are typical examples of scientific coverage in the New Zealand media, as well as getting a general sense of how journalists in this country think about objectivity, verification and balance. These initial observations will be explored in greater depth in Chapter 6 through interviews with journalists who report science.

**Table 3.1.** Headlines of media coverage of the Corngate affair from July 10-27, 2002. The broadcast pieces are either given their headlines according to the broadcaster's website, or a brief explanation is given. The NZPA headlines were collected from the STUFF website (www.stuff.co.nz), which is produced by Independent Newspapers Limited and provides stories from its own publications and the NZPA. I/V = interview; * = stories with an NZPA by-line.

| DATE | NZPA HEADLINES ON STUFF* | BROADCAST LEADS | PRESS HEADLINES |
|---|---|---|---|
| 10 JULY 2002<br>(Wed) | "Food companies deny their sweet corn crops were GE"<br>"Clark outraged by GE revelations"<br>"NZ hit by GE contaminated corn – Hager" | Story breaks on National Radio's Morning Report<br>I/V Nicky Hager (Nine to Noon, National Radio)<br>"Government stands accused of a major GE cover up…" I/V Marian Hobbs, Bill English, Helen Clark and Jeanette Fitzsimons (Checkpoint, National Radio)<br>Claims of government cover up and effects on election (TV3 NEWS)<br>I/V Helen Clark and Special Report (TV3 NEWS)<br>Reaction from politicians and pollsters (Nightline, TV3)<br>Allegations of government secrecy over contaminated corn (ONE News)<br>"Food industry responds to GE claim" (ONE News)<br>"PM furious over GE claims" (ONE News)<br>I/V Pete Hodgson, Jeanette Fitzsimons & Simon Brown (ONE Late Edition)<br>I/V Helen Clark over claims of cover-up (Holmes, TV ONE) | "GE seed blunder covered up: book" (*Waikato Times*)*<br>"GE scandal hushed up" (*Marlborough Express*)<br>"Government accused of covering up GE corn release" (*Marlborough Express*) |

| | | | |
|---|---|---|---|
| 11 JULY<br><br>(Thurs) | "Corngate: Public servants go to bat"<br>"Government finds voice over GE corn scare"<br>"Talk to officials, says Clark"<br>"GE planted 'accidentally'"<br>"Clark livid over GE revelations" | "Open warfare" between Greens and Labour over book; I/V Clark, Fitzsimons and English (Morning Report, National Radio)<br>Questioning of claims; I/V Francis Wevers, Hobbs, Hager (Morning Report, National Radio)<br>Growers still want answers (Rural News and Morning Report, National Radio)<br>"GE cover-up debate rages on" (Midday, TV ONE)<br>"Scientists squash corn concerns": Barry Carbon and Gail Timmerman-Vaughan speak out (ONE News)<br>Effects of Hager's claims on election (ONE News)<br>What is Bt11 and is it fit for human consumption? (ONE News)<br>"Farmers concerned about reputation" (ONE News)<br>How do we know if food is genetically modified? An explanation of testing (ONE News)<br>Scientists deny claims: I/V Russell Poulter and Basil Walker (Holmes, TV ONE)<br>Effects of Hager's claims on Clark's reputation (Holmes, TV ONE)<br>"Expert says GE scare false alarm": Carbon and Poulter speak out (ONE Late Edition)<br>Carbon and Poulter refute claims but Hager stands by them (TV3 NEWS)<br>Effect of claims on election (TV3 NEWS)<br>Clark accuses TV3 of ambush (TV3 NEWS)<br>Reaction to claims from organic farmers (TV3 NEWS)<br>I/V Hobbs and Hager (TV3 NEWS) | "Book says NZ suffered major accidental release of GE sweet corn" (*New Zealand Herald*)<br>"GE seed planted 'accidentally'" (*Dominion Post*)<br>"Hobbs takes hard line" (*Dominion Post*)*<br>"The saga of the imported seeds: what happened?" (*Waikato Times*)<br>"Claims of cover-up may be hard to sustain" (*Otago Daily Times*)*<br>"Suspect seed never left Timaru store" (*Timaru Herald*)<br>"Author manipulated media, candidate claims" (*Marlborough Express*)<br>"Fitzsimons calls for tests on land where alleged GE crops grew" (*New Zealand Herald*)*<br>"Greens accused of dirty play on GE" (*Dominion Post*)<br>"Green Party to rethink joining government: Labour accused of cover-up over GE sweet corn" (*Otago Daily Times*)<br>"Row is a matter of integrity: Greens" (*Nelson Mail*)<br>"Farmers hope harvests stay true" (*NZ Herald*)<br>"Sweet corn processors deny crops were from GE seed" (*Otago Daily Times*)*<br>"Clark in fury at GE ambush" (*NZ Herald*)<br>"PM claims ambush by presenter" (*NZ Herald*)<br>"Clark boils over" (*Waikato Times*)<br>"Fallout over GE corn claims" (*The Press*) |

| | | | |
|---|---|---|---|
| 12 JULY<br><br>(Fri) | "Officials believed NZ was headed for a GE-tolerant regime"<br>"GE contamination not ruled out – ERMA"<br>"Dirt from shovel to blame – genetic lecturer" | I/V Claire Robinson and Tim Bale on effects on Clark's image and the election (Breakfast, TV ONE)<br>I/V Basil Walker (Checkpoint, National Radio)<br>"ERMA director backs Clark on GE": Lindie Nelson speaks out (ONE News)<br>Government documents released today (ONE Late Edition)<br>Walker breaks the party line: no guarantee contamination was not present (TV3 NEWS)<br>Government releases documents but no smoking gun; Hager stands by claims (TV3 NEWS) | "Officials say crop was not tainted" (*Dominion Post*)<br>"Clark promises corn inquest" (*The Press*)<br>"GE corn inquiry agreed to by government" (*Otago Daily Times*)*<br>"Government wheels out public servants: All hands on deck to allay GE fears" (*Otago Daily Times*)<br>"Soil now blamed for GE scare" (*NZ Herald*)<br>"Contaminant 'natural'" (*Otago Daily Times*)<br>"Shovel of corn seed dominates election" (*Dominion Post*)<br>"Dirt blamed for corn scare" (*The Press*)<br>"White allays fears about Erma practices" (*Evening Standard*)*<br>"No change to policy – Hobbs" (*Dominion Post*)*<br>"Clark told to take 'creep' Campbell on" (*NZ Herald*)<br>"TV3 hits back after furious attack by PM" (*The Press*)<br>"Seeds of dissent" (*Dominion Post*)<br>"Growers dismiss cover-up claims" (*Dominion Post*)<br>"Hager stands by claim, protects sources" (*Marlborough Express*) |

| | | | |
|---|---|---|---|
| 13 JULY<br><br>(Sat) | "GE contamination not ruled out – Erma" | "Call for Hager to apologise" but Hager stands by claims (ONE News)<br>Politicians comment on released papers (TV3 News) | "GE contamination not ruled out" (*Otago Daily Times*)*<br>"Cornfusion over truth of key issues" (*Waikato Times*)*<br>"The seeds of dissension" (*NZ Herald*)<br>"Corn crusade latest mission for activist" (*NZ Herald*)<br>"Fitzsimons plays wait and see on GE report" (*NZ Herald*)<br>"Officials noted political risks" (*NZ Herald*)<br>"Too much drama in GE issue – regulator" (*Dominion Post*)*<br>"Warning of ruin if total GE seed ban imposed" (*Dominion Post*)*<br>"Fears GE ban would ruin seed industry" (*Otago Daily Times*)*<br>"TV3 field public complaints over Helen Clark interview" (*NZ Herald*) |
| 14 JULY<br><br>(Sun) | "Government works to reduce fallout" | "Corngate still centre stage" (ONE News)<br>Media ill-prepared to handle science underlying Corngate, I/V Jim Tully, Vicki Hyde (Mediawatch, National Radio) | "The aftermath of the ambush" (*Sunday Star-Times*) |
| 15 JULY<br><br>(Mon) | "Corn compensation less than $900,000 – report"<br>"Fallout from GE corn scare continues" | Papers released since Corngate reveal "confusion and argument within Government" (Morning Report, National Radio)<br>"Scientist questions government corn stance": I/V Wills (ONE News)<br>"GE documents show confusion" (ONE News)<br>Released papers show PR companies may have had inappropriate influence on Government (TV3 News)<br>Wills says released documents do not disprove contamination (TV3 News) | "$900,000 bill for ripping up corn crops" (*The Press*)*<br>"GE moratorium criticised" (*Otago Daily Times*) |

| | | | |
|---|---|---|---|
| 16 JULY<br><br>(Tues) | | | "Hobbs denies industry involved in GE policy" (*Dominion Post*)<br>"Greens, National keep heat on Government" (*Otago Daily Times)** |
| 17 JULY<br><br>(Wed) | | | "'No regrets' over spats: Interview 'worst journalism'" (*Otago Daily Times*)* |
| 18 JULY<br><br>(Thurs) | | | "PM lays complaint" (*Dominion Post*) |
| 20 JULY<br><br>(Sat) | | | "Corngate: lend me your ears (*The Press*)<br>"Planting the seeds of doubt" (*NZ Listener*) |
| 21 JULY<br><br>(Sun) | | I/V Hager on media handling of claim (Mediawatch, National Radio) | |
| 27 JULY<br><br>(Sat) | | | "Bad Seeds" (*NZ Listener*) |

# CHAPTER 4:

# A SURVEY OF NEW ZEALAND JOURNALISTS WHO REPORT SCIENCE

## 4.1. Introduction

Currently, about 2,500 journalists are employed in New Zealand (Tidey 2002). Most of these journalists work for one of the country's four metropolitan daily newspapers[6], two Sunday papers or one of the many small provincial and community papers. A smaller number of journalists work for one of the two television networks with national news coverage (TVNZ and TV3), or for one of the three radio news providers (Radio New Zealand News, Independent Radio News and RadioWorks).

Although New Zealand has few reporters compared to large countries such as the United States and Britain, this figure is comparable to other countries when viewed as a per capita statistic. For example, in the mid-1990s the United States had about 122,000 journalists, or about one journalist for every 250 people (Weaver and Wilhoit 1996), whereas New Zealand has almost one journalist per 167 people.

Still, the number of journalists working in New Zealand has declined significantly since the late 1980s when the industry was deregulated and many journalists either lost or left their jobs (Norris 2002). As a consequence, critics have been concerned at the alarming cut in resources for New Zealand news. In particular, specialist reporting may have suffered, with fewer journalists forced to cover more rounds and stories with fewer resources (McGregor and Comrie 2002). With small staff numbers to begin with, most media organisations in New Zealand could never afford specialists on many rounds, but those constraints seem tighter now than they ever have been. We will see that these

---

[6] In 2000 when this survey was conducted, New Zealand had five metropolitan newspapers, but since then two of these papers, *The Evening Post* and *The Dominion* have merged to form *The Dominion Post*.

constraints have meant that for most media organisations here, science is nothing more than an 'add-on' to journalists' other primary tasks.

No previous studies have been conducted to look specifically at journalists who report science for the New Zealand mass media. This survey was designed to provide background information about who reports science in the New Zealand mass media and how their individual characteristics may influence the production of science media content here. For example, if few reporters have rounds with an explicit focus on science, less science news is likely to be produced. Similarly, the amount of time that a reporter spends covering science, as well as their experience reporting science and scientific training, could influence the way that they report science. Journalists were also asked what factors they thought limited their ability to cover science effectively.

This survey was also used as a preliminary investigation into the attitudes that journalists have towards maverick science, verification, balance and the weight of evidence approach. The goal of this portion of the survey was to generate ideas about these concepts that could be studied further through a content analysis of New Zealand news (see Chapter 5) and interviews with journalists (see Chapter 6).

## 4.2. Methods

A letter was sent to the editors of 25 daily newspapers (the five metropolitan papers and 20 daily provincials)[7], the two national Sunday papers (*Sunday Star-Times* and *Sunday News*), TVNZ, TV3 and National Radio. The editors were asked to identify reporters at their news organisation who covered the six rounds under which it was thought that the majority of science and technology stories would probably be covered: agriculture, environment, education, health and medicine, computers/ IT and science. The editors were also asked to identify any other reporters who covered science and technology, and

[7] The titles were: Ashburton Guardian, Bay of Plenty Times, The Daily News, Daily Post, The Dominion, The Evening Post, The Evening Standard, The Gisborne Herald, The Greymouth Evening Star, Hawke's Bay Today, The Marlborough Express, The Nelson Mail, The New Zealand Herald, The Northern Advocate, The Oamaru Mail, Otago Daily Times, The Press, The Southland Times, The Timaru Herald, Waikato Times, Wanganui Chronicle, The Westport News and the West Coast Times.

they were asked to give their permission for all of the reporters to respond to a survey. Science and technology was defined broadly, including coverage of health, medicine and the environment.

Three editors declined to participate and three editors said that their organisation was too small to have specific reporters who cover scientific stories. The remaining 24 editors provided the names of 90 reporters who covered one or more of the six rounds identified above.

Survey questions were developed and pre-tested on a freelance science writer, an editor for a medical magazine and a communications officer at a government department. The survey was divided into five sections (see Appendix 1 for the full survey). The first section contained four questions about how journalists view the New Zealand media in general and how media coverage might be improved. Section two included three questions about how journalists gather and verify information for science stories, and section three included five questions about the balance and weight of evidence approaches to reporting science. Section four followed on with seven questions about how journalists cover maverick science and scientific controversies. Finally, section five contained nine questions to provide demographic and background information about the survey participants.

The 90 mass media reporters were sent the survey on 24 October, 2000. Reporters who did not believe they covered science and technology stories as defined were asked to respond briefly by mail or email.

Two written reminders were sent on November 3 and November 15, 2000 to journalists who did not respond to the survey request. Journalists who did not respond to the second reminder were given a third reminder by phone or e-mail during the first week of December 2000.

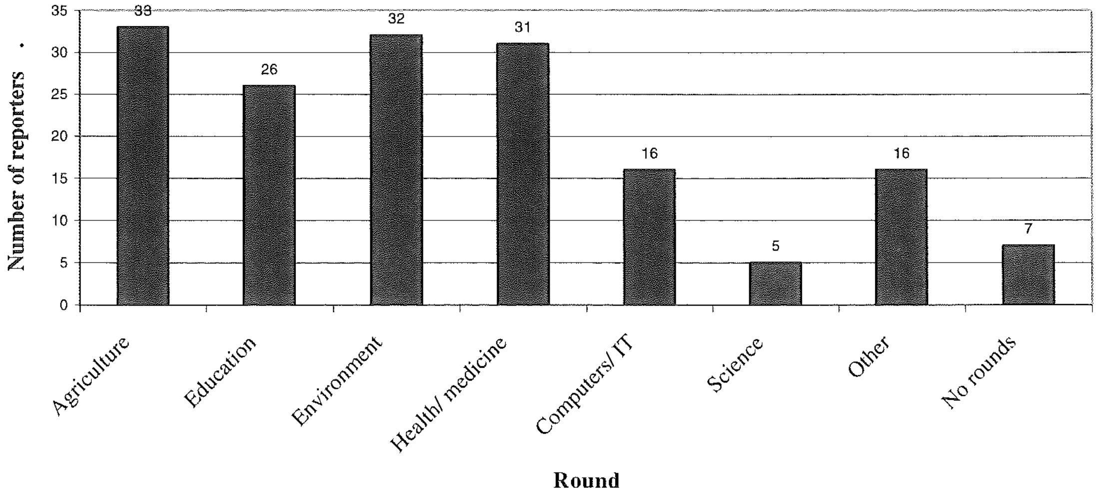
## 4.3. Results

### 4.3.1. Journalist attributes

Of the 90 journalists who were sent a survey, 79 responded, for a response rate of 87.8%. Fifteen journalists responded that they did not report science and technology (although several health and environment reporters declined to respond, which suggests that at least some reporters did not follow the broad definition of science printed on the survey). Thus, a total of 64 completed surveys were received from journalists.

Figure 4.1 shows which rounds the journalists covered. Seven journalists worked at news organisations that did not use a round system. The majority (78.9%) of the remaining 57 journalists said that their rounds were regularly rotated, and most of them covered more than one round. The most common rounds were agriculture, education, environment and health/medicine, with 40-50% of respondents covering each of these rounds. Only five journalists had a specific science round and all five also covered other rounds in addition to science.

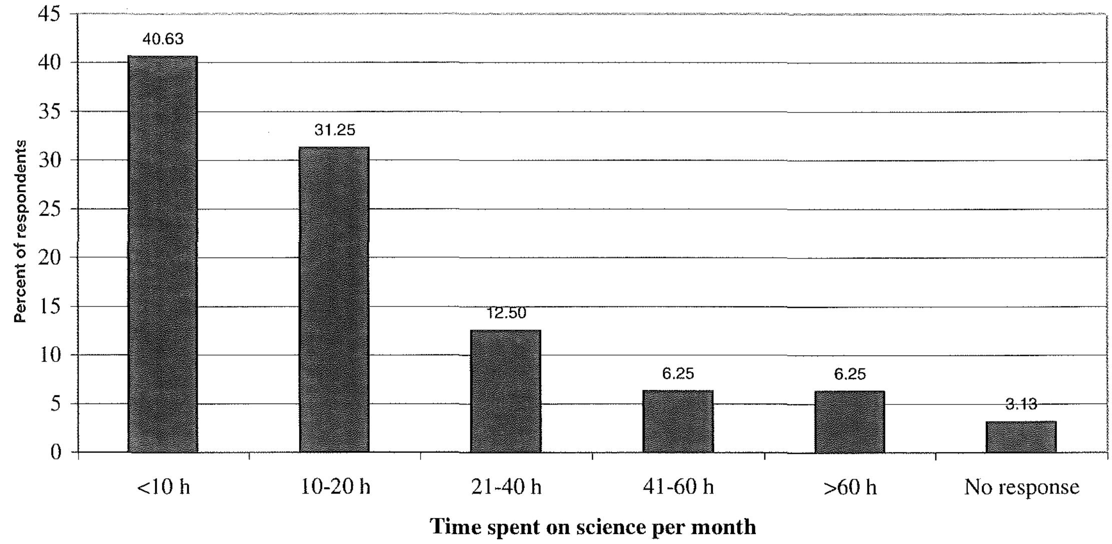
**Figure 4.1.** The number of journalists responding to the survey (n = 64) who covered science under the following rounds. Note that each journalist could cover more than one round, so the total number of reporters summed across all rounds equals more than 64.



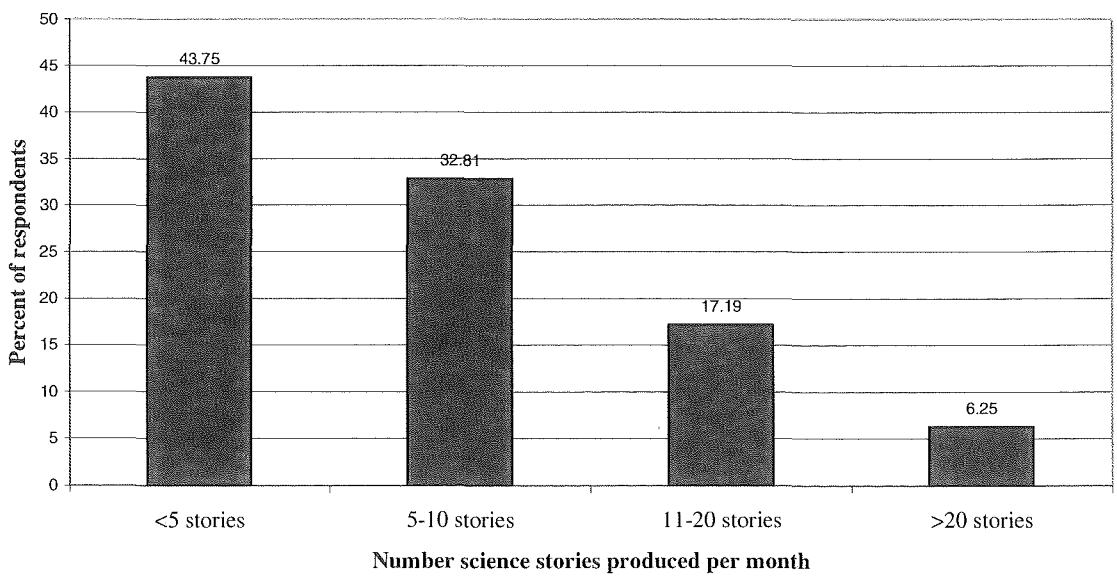
The majority of respondents (71.9%) worked on average less than 20 hours per month covering science stories (Fig. 4.2a), and 76.6% produced fewer than 10 stories each month (Fig. 4.2b). Only 12.6% of the reporters spent more than a quarter of their time (i.e. more than 40 hours) each month on science stories.

**Figure 4.2.** **a)** The average number of hours per month spent covering science stories by the 64 reporters who responded to the survey, and **b)** the number of science stories produced per month on average by the survey respondents.

**a)**

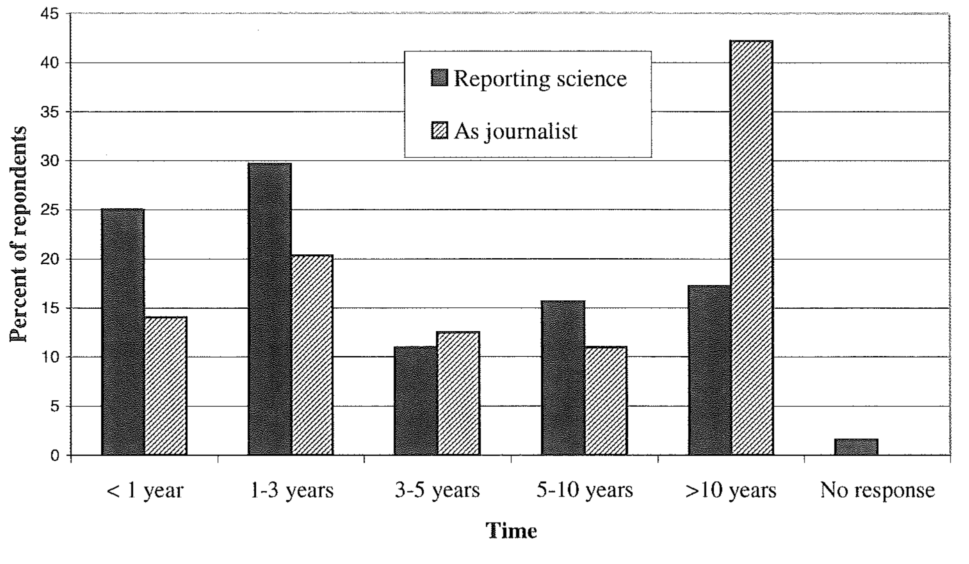



**b)**



Almost half of the respondents (42.2%) had been working as a journalist for more than ten years, while 34.4% had been working as a journalist for less than three years (Fig. 4.3). In contrast, only 17.2% of the journalists had been reporting science for more than ten years while 54.7% had been reporting science for less than three years (Fig. 4.3). Most of the journalists (68.8%) had not studied science beyond secondary school. Only three (4.7%) had completed an undergraduate university degree in science, and an additional four journalists (6.25%) had a postgraduate degree in science.

**Figure 4.3.** The number of years that the surveyed journalists (n = 64) had spent working as a journalist and reporting science.

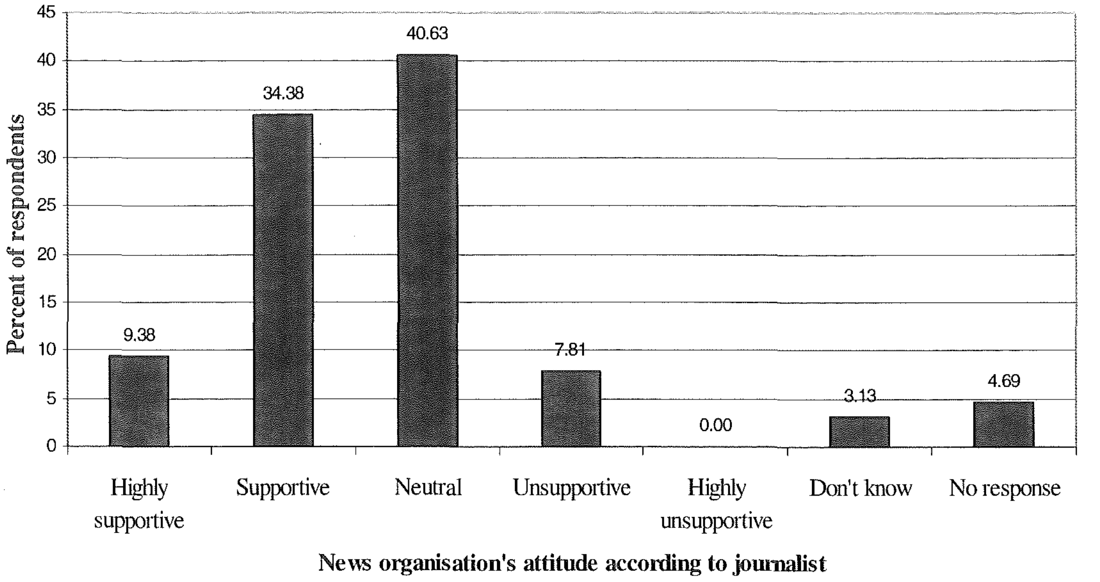



### 4.3.2. Media attitudes toward science

Despite the relatively small amount of time the respondents spent covering science stories, 39% of the journalists said they wanted to spend more time reporting science. Only two respondents said they wanted to spend less time covering science.

Most of the journalists surveyed believed that their news organisation had either a supportive or neutral attitude toward science news (Fig. 4.4). Only five journalists (7.8%) said that their news organisation was not supportive of science coverage.

**Figure 4.4.** How survey respondents rated their news organisation's attitude toward science news.




One of the survey questions asked journalists to identify the three scientific fields that their news organisation covered most frequently and the three fields that they believed should get the most attention from their organisation. The fields that journalists identified as receiving the most attention matched very closely to the fields that they believed should get the most attention, suggesting that they were satisfied with the range of scientific fields currently covered (Fig. 4.5). Agriculture/farming/horticulture, environment/ecology/conservation, and medicine/nutrition/health were rated as the fields that both *did* receive and *should* receive the most media attention. Other popular fields were computers/technology and climate/atmospheric studies.

Figure 4.6 shows how the journalists rated the quality of science news in different New Zealand media. The journalists rated Radio New Zealand's science coverage significantly higher than the other media's science coverage when the "don't know" responses were omitted ($F = 14.55$, $p < 0.001$). The mean rating for RNZ science coverage was 'good', compared to a mean rating of 'fair' for each of the other four media categories (metropolitan newspapers, provincial newspapers, TVNZ and TV3). However, a higher percentage of respondents (20.3%) answered "don't know" for Radio New Zealand's rating than for the other media (3-13%).

**Figure 4.5.** The number of survey respondents that rated each topic within the top three scientific fields that currently receive the most attention from the New Zealand mass media and in the top three fields that should receive the most attention.

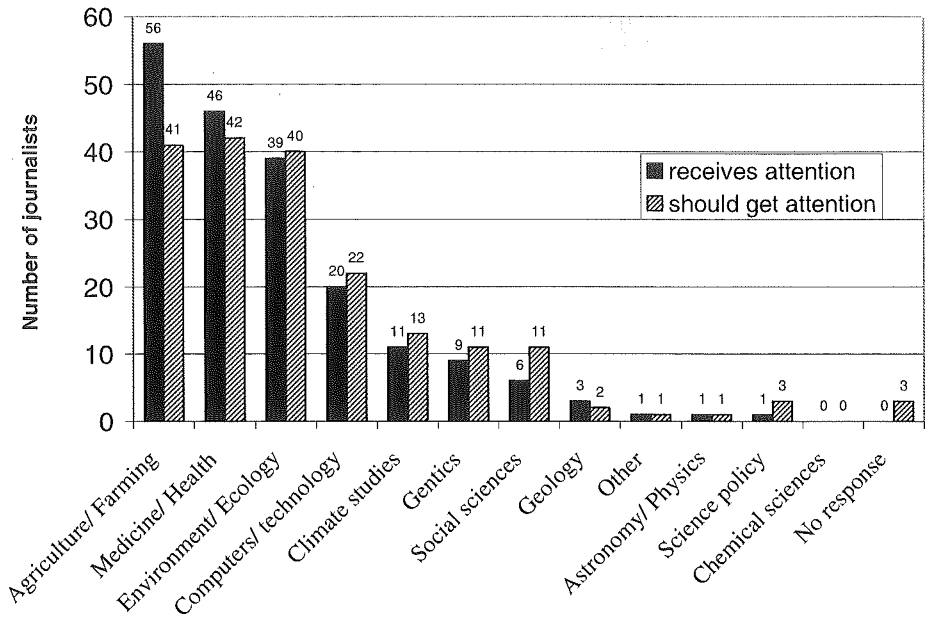
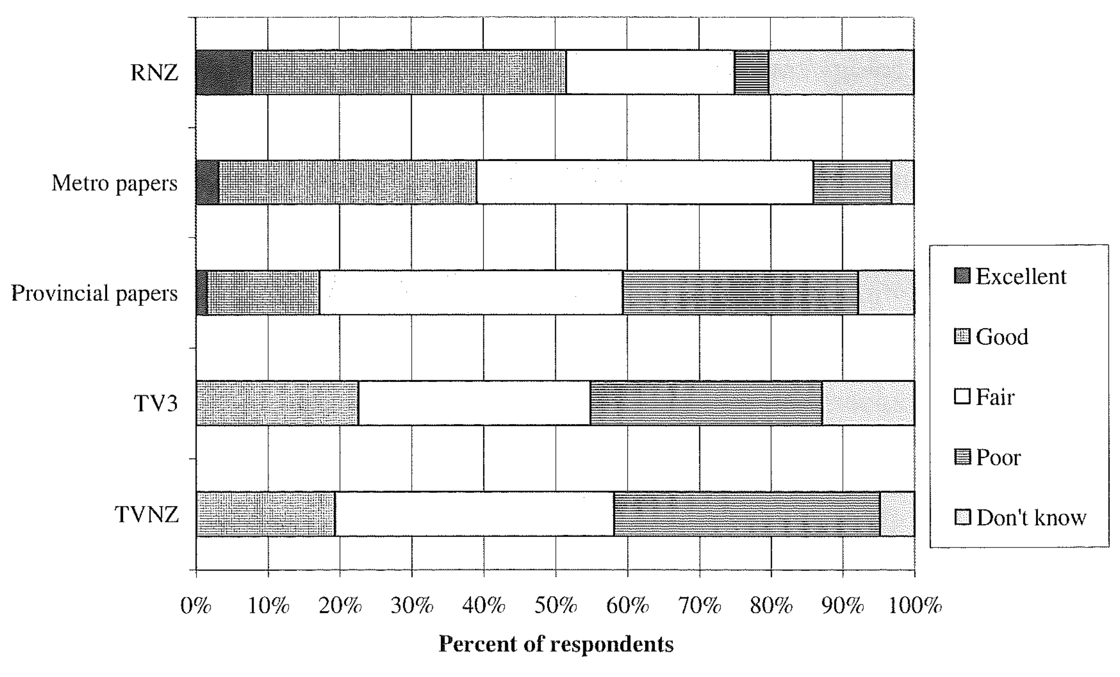



**Figure 4.6.** The percentage of survey respondents that rated the quality of the New Zealand metropolitan newspapers, the provincial papers, TVNZ, TV3 and Radio New Zealand as 'excellent', 'good', 'fair', or 'poor'.



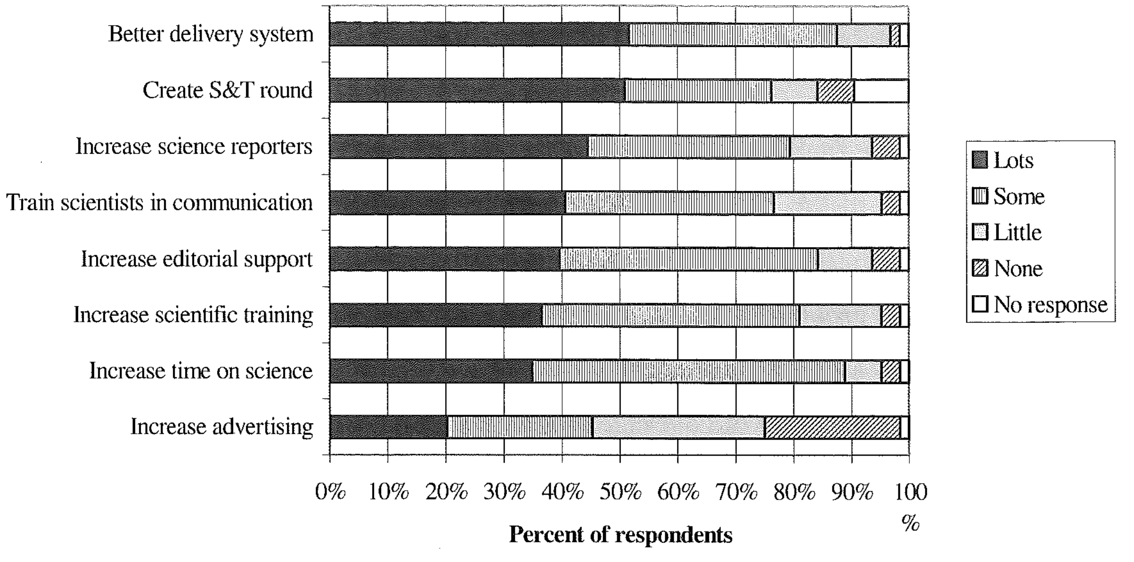
Thirty-nine percent of respondents rated the science coverage in metropolitan papers either 'good' or 'excellent', and only 10.9% rated it 'poor'. Journalists rated the science coverage in provincial newspapers and the two television stations similarly, with less than a quarter rating the coverage 'excellent' or 'good', and about one-third rating it 'poor'.

The majority of journalists surveyed (54.7%) said that both the quantity and quality of science coverage in the New Zealand mass media were equally important problems. One quarter thought that the quality of science coverage in the New Zealand media was a more important problem than the quantity of that coverage, while only 7.8% thought that quantity was a bigger problem than quality. Thirteen percent thought that neither the quality nor the quantity of coverage was an important problem.

Journalists were also asked whether each of eight potential changes would improve the quality of science coverage in their news organisation: 1) increasing the number of science reporters, 2) increasing the amount of time spent reporting science, 3) creating a formal science and technology round, 4) increasing editorial support for science, 5) increasing scientific training for journalists, 6) improving the system of delivering news from scientists to the media, 7) increasing advertising in the science sector and 8) increasing communication training for scientists. More than 75% of respondents thought that all but one of the proposed changes would improve the quality of science coverage either ‘lots’ or ‘some’ (Fig. 4.7). Just under half of the journalists (45.3%) thought that an increase in advertising from the science sector would improve the quality of science reporting.

The greatest number of journalists said that the quality of science coverage could be improved 'lots' by creating a formal science and technology round (56.1%) and by creating a better news delivery system from scientists to the media (51.6%). One journalist suggested that new releases should be sent directly from science organisations to the media, rather than through public relations companies. The greatest number of journalists said that the quality of science coverage could be improved 'lots' or 'some' by increasing the time spent reporting science (87.5%).

**Figure 4.7.** The percent of respondents that thought that the following changes would improve the quality of science coverage in the New Zealand mass media 'lots', 'some', 'little', or 'none'.




Some journalists also commented on the need for scientists to communicate in more accessible language and to make science "relevant to ordinary people". Reporters felt that scientists used too much jargon and often were reluctant to speak with the media, particularly when the research was new or still in progress.

The majority also said that improving the scientific training of journalists might help, and that they were limited by their understanding of scientific topics. Most of the reporters were not trained in science beyond the secondary school level. Several journalists disagreed that scientific training would help, however, since, as one reporter stated, "If a non-scientific reporter can understand what s/he writes, the chances are the reader will too."

The rotation of rounds under which science is covered, a lack of organisational support, and a lack of advertising in the science sector did not appear to be important problems for these journalists. However, the majority of reporters did think that an increase in editorial support would improve science coverage, and some reporters noted the large influence that editors have over science coverage. Several commented that "having people at the top who are enthusiastic about science" might help and that it was important for editors as well as journalists to receive scientific training.

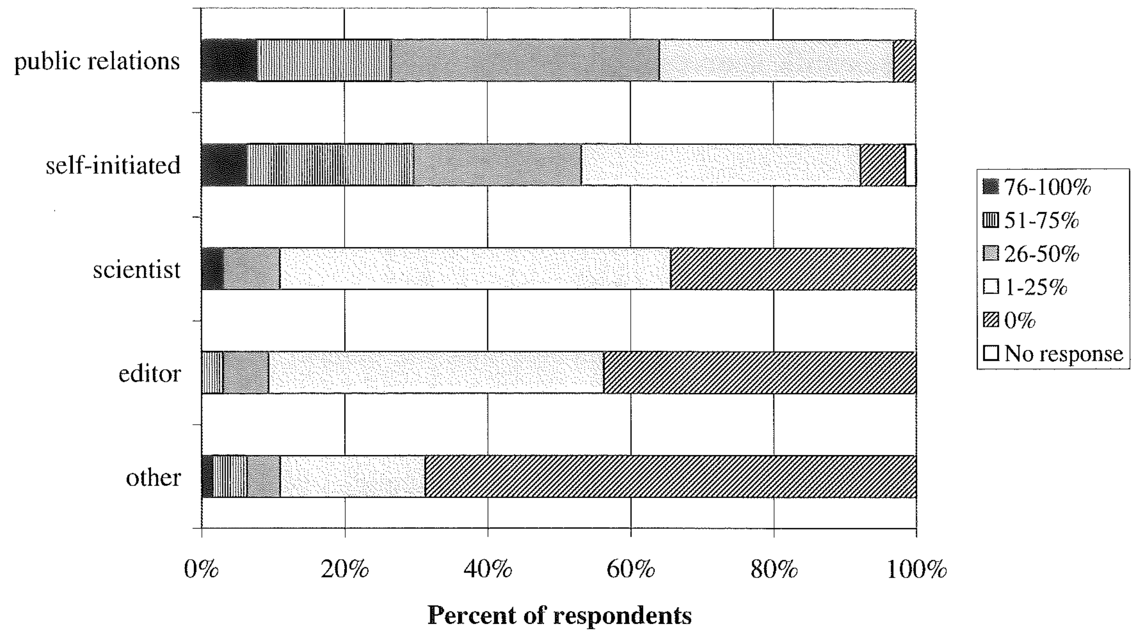
### 4.3.3. The use of scientific sources

The average number of scientists that journalists said they usually contacted for a science story was 2.1. One quarter of the journalists said that they would contact only one scientist for information, while slightly less than half (48.4%) said that they would contact two scientists. Ten reporters (15.6%) said that they would typically contact three or four scientists. Some reporters commented that the number of scientists that they contacted varied widely between stories.

The average number of sources that journalists said they sought out for scientific stories was not significantly related to the number of hours the journalists spent reporting science ($R^2 = 0.02$, $F = 1.04$, $df = 1, 62$, $p = 0.31$), the number of stories they produced ($R^2 = 0.00$, $F = 0.003$, $df = 1, 62$, $p = 0.96$), their scientific training ($R^2 = 0.01$, $F = 0.46$, $df = 1, 62$, $p = 0.50$), their experience as a journalist ($R^2 = 0.01$, $F = 0.54$, $df = 1, 62$, $p = 0.47$) or their experience in science reporting ($R^2 = 0.02$, $F = 1.58$, $df = 1, 62$, $p = 0.21$).

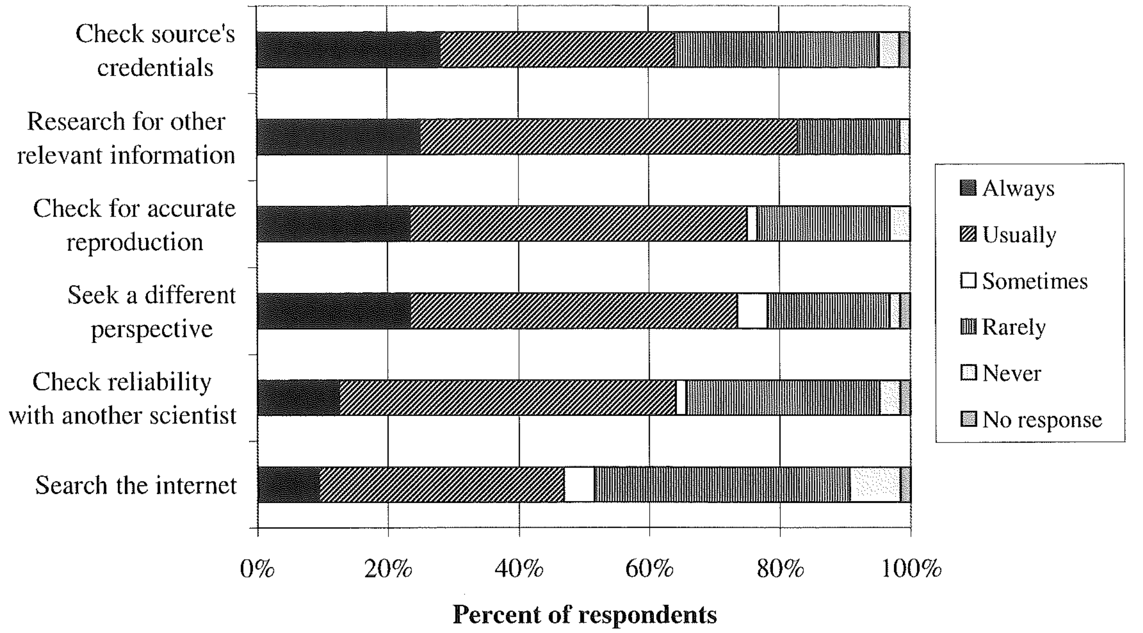
Figure 4.8 shows that for most of the surveyed journalists, a variety of people initiated their science stories. The mean percent of stories initiated by each source for all of the respondents was calculated by totalling the number of responses per category (0%, 1-25%, 26-50%, 51-75% and 76-100%) multiplied by the category midpoint (i.e. 0%, 12.5%, 38.5%, 63.5% and 88.5%) and dividing by the total number of responses. Using these rough mean estimates, public relations officers or the journalists themselves initiated science stories most often. Scientists, editors or other sources initiated about one-third as many stories.

**Figure 4.8.** The percent of survey respondents who said that they rely on these sources to initiate their science stories at the frequency specified.




Once a science story is underway, journalists were asked whether they then 'always', 'usually', 'rarely', or 'never' verify the information given to them by a scientist. Several respondents wrote in a 'sometimes' response, indicating that this intermediate category should have been an option for this survey question. Most of the journalists (82.8%) said that when a scientist gave them a statement, they would always or usually search for other information on the topic through interviews or research (Fig. 4.9). Only 46.9% said that they would always or usually check the internet for information. The majority of respondents also said that they would always or usually: 1) look for another source to provide a different perspective (73.4%), 2) check the reliability of the statement with a second scientist (64.1%) and 3) check the scientist's credentials (64.1%). Several journalists noted that ideally they would like to do all of these things, but that limited time usually prevented them from achieving these goals.

**Figure 4.9.** The percent of respondents that answered that they do the following things when writing a science story 'always', 'usually', 'sometimes', 'rarely', or 'never'.




### 4.3.4. Coverage of maverick science

Maverick science was defined in this survey as unorthodox science that only one or a few scientists believe is credible. Most journalists said that they did not frequently write stories about maverick science, but they did not indicate that they were against covering maverick science in principle. All of the journalists who responded said that less than 25% of the science stories that they wrote focused on maverick science, and 31.3% said that they covered no maverick science at all. However, 60.9% of the journalists said that they would include a statement from scientists opposing a scientific claim that was generally agreed upon by the scientific community. None of the journalists said that they would not include the maverick statement.

Moreover, when the journalists were asked how they would be most likely to report a maverick science story, 62.5% of the respondents said that they would report the story as an unresolved scientific controversy with claims from scientists on both sides. None of the journalists said that they would report the claim unqualified, but on the other hand, only one person said that s/he would not report the story since the science was not credible. Almost a quarter of the journalists (23.4%) said that they would report the maverick claim but discredit it using statements from other scientists, and five journalists said that they would report the claim as a discovery with a brief qualifying statement from a mainstream scientist.

From these responses, it would seem that the majority of respondents thought that maverick scientists should be given equal coverage to mainstream scientists. However, the journalists were evenly divided over whether mainstream claims should be given more proportional coverage (i.e. weight, time or space) than maverick claims. Almost half of the respondents (48.4%) said that it would depend on the particular issue at stake.

### 4.3.5. The weight of evidence approach

Some science communication specialists have suggested that journalists should report science stories using a "weight of evidence" approach, where the journalist conducts interviews and/or research to evaluate the scientific claim and suggests whether it is supported by adequate scientific data (Dunwoody 1999). The majority of the journalists (65.6%) said that *in principle* they thought the weight of evidence approach was an appropriate strategy for journalists who cover science. Moreover, 81.2% of the journalists said that when reporting controversial scientific claims, the journalist should always or usually provide details about which perspective is supported by the weight of evidence.

In contrast, the journalists did not approve of the weight of evidence approach in a practical example. One survey question asked whether a journalist who conducted research and found that the weight of evidence did not support a scientific claim should report that in her story. Half of the journalists said that it was not appropriate for her to evaluate the claims in the story herself.

The journalists were also asked whether it was appropriate for reporters to present their own evaluations of the scientific evidence under nine different circumstances (see Appendix 1, question 12). Thirty-nine percent thought that it was appropriate to include the evaluations in any story, provided that adequate research was done to back them up. Just over half of the respondents (55%) said that it was appropriate for the journalist to evaluate scientific evidence if s/he had adequate and appropriate scientific knowledge. Four of the journalists (6.25%) wrote in that evaluations were only appropriate in opinion pieces.

When asked what responsibilities they would have in researching and presenting a controversial new medical treatment, more than three-fourths of the journalists said that they would feel responsible for: 1) interviewing scientists who both support and dispute the claim and present their perspectives with equal weight (87.5%); 2) finding one or more other experts in the field to evaluate the claims (78.1%); 3) finding out the sample size and duration of the study (84.4%); 4) finding out what problems or limitations the discovery might have (85.9%); and 5) finding out how much more testing would be needed before the new treatment might be available (82.8%). A majority of the journalists (67.2%) also thought that they should find out what previous research on the disease had been done. In contrast, less than half (48.4%) said that they should be responsible for finding out which claim the majority of scientists in the field would support. Several journalists also commented that ideally they would do all of the listed duties, but they could not do many of them because of constraints such as limited time.

In fact, all but one of the journalists identified time constraints as a restriction to their ability to use the weight of evidence approach and to report on the background, methodology and limitations of scientific claims. Both space constraints and a limited understanding of scientific topics restricted 67% of the journalists. The majority of journalists did not think that a limited knowledge of where to go to find scientific information, limited access to scientific information or fear of losing access to sources were significant restrictions. Alienating scientific sources that could be used in the future did not appear to worry journalists in this survey at all, as 96.9% said they would seek opposing viewpoints even if it angered a key scientific source.

## 4.4. Discussion

### 4.4.1. Science reporting without the specialists

This survey of New Zealand mass media journalists indicates that although a relatively large number of reporters cover some science for the New Zealand mass media, most spend only a small amount of time on the subject. Only five reporters had a dedicated science round at the time of the study, which amounts to only 0.2% of the 2,200 working journalists in New Zealand (Tidey 2002).[8] This number compares to 600-800 science and medical reporters in the United States in the early 1990s (Klaidman 1991), or about 1% of American journalists (Dunwoody 1993), and to about 140 science journalists – or about 6% of all journalists – in Australia in the early 1990s (Metcalfe and Gascoigne 1995).

Furthermore, Australia has at least seven specialist science journalists who cover only science, as well as a number of other specialist environment, medical and computer reporters (Metcalfe and Gascoigne 1995). Metcalfe and Gascoigne (1995, p. 419) call the emergence of specialist science journalists "the biggest development in science journalism in Australia over the past decade." Even our five science journalists can hardly be called 'specialists' in any real sense, since they are all required to cover other rounds besides science.[9] Whereas science specialists in Australia said that they produce more than five news stories per week (sometimes as many as 50) plus at least one to three features per week (Metcalfe and Gascoigne 1995), New Zealand journalists with a science round produce fewer than 20 stories per month in total. Perhaps the only true specialist science reporters in the country are freelancers, a single journalist who writes and produces the only science programme in the country (*Eureka!* on National Radio),

---

[8] Accounting for the three editors who did not respond (11% of the 27 asked to respond) plus the 11 journalists who did not respond (12% of the 90 surveyed), there could potentially be 6 journalists with a science round [(5 x 1.12) + (5 x 0.11) = 6.2], which is still only 0.28% of the 2,200 working journalists in New Zealand.

[9] Since this survey was conducted, however, the *New Zealand Herald*, our country's largest newspaper, has appointed a senior journalist to a full-time science round, although this is broadly defined to include topics such as innovative business and the 'knowledge society'.

and a handful of journalists who write for specialised scientific, environmental and medical publications.

The small number of science rounds in New Zealand may partly reflect the fact that science is not a high priority for most news organisations here. After all, business and sport are two specialist subjects that receive enormous resources from many organisations. The fact that the *New Zealand Herald*, our country's largest newspaper, recently appointed a senior journalist to a full-time science round is encouraging; perhaps science reporting may become a higher priority in the future.

However, it is important to recognise that the small number of science reporters here is also a reflection of the simple fact that New Zealand – and hence its media organisations – are small. As a result, news organisations have few resources to devote to specialist reporting. Other small countries also do not have a cadre of specialist science reporters. For example, a 1988 study of Norwegian journalists showed that only 5% of the journalists in that country had a dedicated science round and all of them had to cover other rounds as well (Eide and Ottosen 1994). Canada, which had 114 daily newspapers in 1994, only had 87 reporters who covered the science round and only 18 of these reporters said that they covered science-related stories full-time (Saari et al. 1998). Even Britain, which has a substantial history of academic inquiry in the field of science communication only had 16 full-time journalists in the mid-1990s who were responsible for most of the science, medical and technology stories in Britain's broadsheet newspapers (Wilkie 1996).[10]

Specialty reporting can be advantageous because dedicated rounds define which events are likely to be covered. Events that fall neatly under a dedicated round will be more likely to be reported than events that are not directly relevant to any dedicated round (Tuchman 1972). Moreover, specialist science reporters may have more time to spend on science and may develop more experience reporting science. Wilson (2000) conducted a study of American journalists who covered climate change, and he found

[10] Hansen (1994) interviewed 31 British specialist science journalists in 1990, but he included both broadsheets and three national tabloids, as well as seven environment/agriculture reporters.

that the strongest predictor of climate change knowledge was the amount of time that the journalist spent on ~~climate~~ environmental issues. Similarly, Einsiedel and Coughlan (1993) found that Canadian full-time environmental writers were more likely to produce longer stories, more analytical stories, to include background information and to recognise uncertainty than general reporters.

On the other hand, Logan et al. (2000b) found that the overall editing and reporting standards within a news organisation influenced long-term news performance more than specialist beats.. Moreover, Metcalfe and Gascoigne (1995) suggest that having specialist science reporters may have disadvantages, because treating science as a discipline separate and distinct from other parts of society reinforces the public perception that science is not relevant to everyday life. They suggest that general reporters need to cover science so that "science can be put into context with the rest of society rather than separated out and mythologized" (Metcalfe and Gascoigne 1995, p. 422).

### 4.4.2. Time constraints

The journalists in this survey overwhelmingly said that limited time was the biggest constraint on science news in New Zealand. One journalist said that time constraints increasingly restricted the amount of time reporters can spend "reading the latest research and journals and keeping up with current debate." S/he said that "such activities are seen as 'non-productive' by editors, and journalists have to do it in their own time, at a time when they work more overtime and increasingly [work] long days simply writing stories, none of which is conducive to having well-informed science reporting."

Some journalists commented that in recent years their responsibilities had grown while their resources had been shrinking. This may be reflective of the impact that deregulation has had on the New Zealand media since the 1980s (see Chapter 5). New Zealand newsrooms today contain fewer journalists, working harder with fewer resources, to produce more stories than ever before (Comrie 2000). One reporter with a dedicated science round said, "When I started here 15 years ago, we had 30 general reporters; now we have 16. I am busier than ever but breaking fewer stories. I'm also now expected to do several rounds." Saari et al (1998) suggest that economic constraints have similarly led to "chronic understaffing" in Canadian newsrooms that has in turn inflicted severe time limitations on science journalists. Time demands limited the Canadian journalists' ability to conduct background research and to critically assess information, and it therefore forced writers to leave international and national research stories to the wire services (Saari et al. 1998).

### 4.4.3. The effects of scientific training and work experience

As well as spending little time on science, most of the journalists surveyed also had little or no formal scientific training and little experience reporting science. Only seven journalists had tertiary degrees in science. Again, this may be reflective of a more general trend toward less experienced reporters in New Zealand since the 1980s (Comrie 2000; Norris 2002), but it is also indicative of worldwide patterns amongst science reporters. The average scientific training of journalists covering science overseas does not appear to be significantly greater than in New Zealand. For example, Weaver and Wilhoit (1996) found that only 3% of American journalists with university degrees majored in mathematics or physical or biological sciences. Metcalfe and Gascoigne (1995) also report that most science reporters in Australia have university degrees but not in the sciences. In a 1994 study, only 20% of science journalists in Canada had a science degree or had taken some undergraduate science courses (Saari et al. 1998).

Increasingly, however, science journalists in the United States, Britain and Australia are trained at one of the many tertiary science writing programmes now available in those countries. In the United States, more than 50 degree courses on science writing have now been established (Dunwoody et al. 1999). No such degree programmes exist yet in New Zealand to train journalists in science writing. Dunwoody (2001) also notes that American science journalists are increasingly scientists turned communicators. Science writers historically have been journalists who were dragged into the ranks of science writing, but an increasing number of American scientists are entering the field for two reasons. First, many of the new academic programmes in science writing privilege students who have science training. Second, scientific culture is increasingly supportive of the popularising of science, because scientists are beginning to recognise the potential benefits of media visibility (for example, there is some evidence to suggest that popular stories confer legitimacy even in the minds of other scientists). Also, employment opportunities in science are increasingly scarce, and many scientists are seeking out alternative careers (Dunwoody 2001). Nonetheless, about 75% of American science writers still have English or journalism degrees (Dunwoody 2001).

Why might scientific training be an advantage for science journalists? After all, most journalists are continually asked to report on a range of issues that they know little about. Moreover, most science journalists must cover diverse scientific disciplines from psychology to chemistry to ecology, and it would be impractical for even a scientist to be trained in all of these areas. For this reason, some authors have suggested that scientific training is important not because of the specific scientific knowledge that it imparts, but rather because it teaches students about the process of science (Anton and McCourt 1995; Wynne 1999). In particular, science training may help journalists gain a general sensitivity toward scientific language (e.g. the implications of phrases such as 'statistical significance'), and it may help journalists understand how to evaluate scientific evidence (Dunwoody 2001). Thirdly, scientifically trained journalists may instil confidence in scientists who deal with them, regardless of whether their training actually makes a difference in practice (Dunwoody 2001).

In fact, the few studies to date that have looked empirically at whether formal training does improve science reporting have largely failed to find any significant effects. Wilson (2000) conducted a study of American journalists who covered climate change, and he found that scientific training did not have a significant effect on climate change knowledge. In another study of American weather forecasters, Wilson (2002) also found that knowledge of climate change was not related to the amount of formal training or education the weathercasters had. Instead, ignorance was connected to values and beliefs held by the weathercasters. Similarly, Weiss and Singer (1988) did not find any relationship between formal scientific training and the journalists' ability to produce stories that their sources judged as accurate and complete. On the other hand, the amount of time spent reporting science may be important. In their study, Weiss and

Singer (1988) found a weak relationship between the journalist's work experience and their ability to produce acceptable stories.

These studies indicate that the normative aspects of being a journalist have at least as great an effect as individual characteristics in shaping science content (Stocking 1999). More specifically, the amount of time that a journalist can spend on an issue and the extent to which their news organisation challenges them to get the story 'right' are probably more important than whether the journalist has formal scientific training. In fact, scientific training may even have disadvantages. Dunwoody (2001) suggests that scientific training may detract from other training opportunities, for example in storytelling, which might hinder their ability to explain science in a clear, interesting and relevant way. Moreover, several journalists in this study said that scientific training could be a disadvantage, because scientifically trained journalists might not ask the questions that a non-scientific audience would want them to ask. A journalist who is not trained in science may ask more probing questions that result in a more clear and comprehensible story for their audience.

In this study, neither the journalists' experience reporting science nor their scientific training had any significant effect on the number of sources that journalists said they typically used for science stories. However, since the survey could only report what journalists say they do rather than what they actually do, it would have been preferable to compare the attributes of the journalists to the actual stories they produced. Unfortunately, the content analysis in this study (see Chapter 5) did not yield enough stories by the surveyed journalists to investigate such patterns.

A final individual-level characteristic that could influence science reporting is personal interest in science and motivation to report it. Critics of science reporting have suggested that science news often gets shoved aside because journalists do not understand – and hence are not interested in – complex scientific topics. On the contrary, this survey shows that despite a lack of training in science and time for reporting it, 39% of the New Zealand journalists surveyed said that they would like to spend more time reporting science. This suggests that working journalists in New Zealand are interested in covering science more than they currently do, but that they are constrained by other forces – most clearly, limited time and a lack of resources for specialised reporting.

It is also possible that gatekeepers do not share journalists' interest in science, and so they limit science content. The majority of reporters said that an increase in editorial support would improve science coverage, but on the other hand, almost three-quarters of the journalists said that their news organisation was either supportive or neutral toward science reporting. Future studies should investigate whether editors do in fact constrain science reporting, or whether organisational factors are more important.

# CHAPTER 5:

# A CONTENT ANALYSIS OF NEW ZEALAND SCIENCE NEWS

## 5.1. Introduction: The New Zealand media environment

While overseas studies of science reporting may apply to New Zealand media in many cases, the relationship between the media and science in New Zealand is shaped by our particular circumstances of small population size, remote location and unique historical, cultural and economic conditions. Therefore, understanding New Zealand's media environment is important to understanding science journalism here.

### 5.1.1. News organisations and their audiences

For its small population of four million people, New Zealand has a particularly large number of news organisations. In print media, the country is served by four metropolitan daily newspapers, 20 provincial dailies, two Sunday papers and two weekly business papers (*National Business Review* and *The Independent*). Only three metropolitan papers and the two Sunday papers have circulations greater than 50,000 (Table 5.1). *The New Zealand Herald* has the largest circulation at nearly 211,000. There are also a number of community papers with a total circulation of about 2.6 million per week (Jeffries 2002).

All of the daily newspapers jointly own the New Zealand Press Association (NZPA), which provides local and international news through a co-operative news-swapping arrangement. The NZPA receives news from all of its member organisations, and then selects and edits stories to disseminate nationally and internationally. NZPA staff also initiate their own news stories, which are transmitted in the same manner to member organisations. International news from Reuters, Associated Press of America and other international agencies and news services is also distributed through the NZPA network.

**Table 5.1.** Daily and Sunday newspapers recognised by the Newspaper Publishers Association in New Zealand in 2003. Circulation and readership figures are from the New Zealand Audit Bureau of Circulations March 2003 audit (New Zealand Audit Bureau of Circulations 2003). NA = data not available.

| **Newspaper** | **Circulation** (March 2003) | **Readership** (March 2003) | **Owner** |
|---|---|---|---|
| *The New Zealand Herald* | 210,910 | 593,000 | Wilson & Horton |
| *Sunday Star-Times* | 203,901 | 600,000 | Fairfax NZ Ltd |
| *Sunday News* | 110,136 | 511,000 | Fairfax NZ Ltd |
| *The Dominion Post* | 99,089 | 272,000 | Fairfax NZ Ltd |
| *The Press* | 91,111 | 239,000 | Fairfax NZ Ltd |
| *Otago Daily Times* | 44,546 | 106,000 | Allied Press Ltd |
| *Waikato Times* | 40,972 | 105,000 | Fairfax NZ Ltd |
| *Hawke's Bay Today* | 30,079 | 70,000 | Wilson & Horton |
| *The Southland Times* | 29,928 | 67,000 | Fairfax NZ Ltd |
| *The Daily News* | 26,794 | 64,000 | Fairfax NZ Ltd |
| *Bay of Plenty Times* | 23,285 | 57,000 | Wilson & Horton |
| *Manawatu Evening Standard* | 20,357 | 51,000 | Fairfax NZ Ltd |
| *The Nelson Mail* | 18,312 | 43,000 | Fairfax NZ Ltd |
| *The Northern Advocate* | 15,112 | 40,000 | Wilson & Horton |
| *The Timaru Herald* | 14,360 | 35,000 | Fairfax NZ Ltd |
| *Wanganui Chronicle* | 14,075 | 29,000 | Wilson & Horton |
| *The Daily Post* | 11,979 | 30,000 | Wilson & Horton |
| *The Marlborough Express* | 10,173 | 24,000 | Fairfax NZ Ltd |
| *The Gisborne Herald* | 8,573 | 20,000 | Gisborne Herald Co Ltd |
| *Wairarapa Times-Age* | 7,585 | 14,000 | Wilson & Horton |
| *Ashburton Guardian* | 5,554 | 14,000 | Ashburton Guardian Co |
| *The Greymouth Evening Star* | 4,266 | 10,000 | Allied Press Ltd |
| *Horowhenua Kapiti Chronicle* | 3,789 | 7,000 | Wilson & Horton |
| *The Oamaru Mail* | 3,464 | 7,000 | Wilson & Horton |
| *Danniverke Evening News* | 2,174 | NA | Wilson & Horton |
| *The Westport News* | 2,010 | NA | The Westport News Ltd |

New Zealand also has one of highest numbers of radio stations per capita in the world (Norris 2002). Radio New Zealand (RNZ), the only state-owned radio broadcaster, is publicly funded and available nationwide. It runs National Radio (a non-commercial station featuring news, current affairs, documentary, drama and some music) and Concert FM (a classical music station). In addition there are a large number of commercial radio stations that belong to nationwide networks (e.g. More FM, Channel Z), a few independent stations and numerous non-commercial stations, including iwi and Pacific Island stations and community, access or trust-owned stations.

Two national television networks have free-to-air New Zealand news coverage. Television New Zealand (TVNZ) is the state-owned broadcaster, which since 1988 has been required to run as a commercial business (see section 5.1.3.1 below). TVNZ runs two channels, TV ONE and TV2, which are both broadcast to about 1.126 million households (almost 100% coverage of the population) and together capture 75% of the free-to-air market (Norris 2002). Of these two, only TV ONE broadcasts national news coverage. The other national television network with New Zealand news coverage is TV3, which began in 1989 as the first private competitor to state-owned TVNZ. In addition, Sky TV, the first pay network in New Zealand, offers access to CNN. Sky began broadcasting in 1990 and more than one-third of New Zealand households now subscribe (Norris 2002). Several other stations also show international news coverage, such as Australia's Channel 9 news on the Prime network and BBC World News on TV ONE.

To match this abundance of available media, New Zealanders are avid media consumers. One million people (one quarter of the country's population) watch the evening television news on an average night, and TVNZ's evening news programme (ONE News) has been the country's top-rating programme for years (Comrie 2000). On a typical day, nearly 1.7 million New Zealanders over 15 years of age read a newspaper, and they spend on average more than $4 million per week on newspapers (Newspaper Publishers' Association 2002).

### 5.1.2. Regulatory bodies

The print media in New Zealand have a self-regulatory body, the New Zealand Press Council, which was established in 1972. It is modelled on the British system of 'self-regulation' whereby media organisations are responsible for setting their own standards and guidelines for ethical and professional conduct. The Council has no punitive powers and had no written code until relatively recently. In 1999, the Council finally produced a statement of 12 principles as a guideline to ethical practice (see www.presscouncil.org.nz/principles.htm), which has been criticised for failing to adequately address ethical issues such as fairness, independence and truth-telling (Tully and Elsaka 2002).

The broadcast media, however, have a regulatory body, the Broadcasting Standards Authority (BSA), which was created by the Broadcasting Act 1989. It is a statutory watchdog responsible for developing the approved codes of practice. It has a statutory obligation to initiate research and to revise the codes as necessary. Unlike the Press Council, the BSA has significant punitive powers, which range from forcing a network to read a retraction or apology on air to taking a station off air for up to twenty-four hours.

### 5.1.3. Deregulation and its impacts on the New Zealand media

The key characteristic that distinguishes the mass media in New Zealand internationally is the extent to which it is deregulated. As Norris and Pauling (1999, p. 11) put it, New Zealand is "at the end of the international continuum in terms of its minimal amount of intervention and legislation in broadcasting matters."

This extreme deregulation has had two major effects. First, the New Zealand media have few incentives for providing public service content or local content. New Zealand has the only state-owned broadcaster in the world (TVNZ) that is required to make a profit (Norris and Pauling 1999), and TVNZ is unique among state-funded broadcasters in not having programming requirements, restrictions on advertising or mechanisms (e.g. quotas) for local content. Up until last year (2002), it did not even have a charter of public-service programming objectives.

Second, deregulation has caused many news organisations to be sold to a few multinational corporations. Global media conglomeration is a trend in most countries around the world, and by 2001, the global media were dominated by just seven multinational corporations (McChesney 2001). However, unlike most other countries, New Zealand has no restrictions on foreign ownership or on cross-media ownership (Comrie 2000). This has led to a situation that is "without parallel in the Western world" (Norris 2002, p. 36), with every major media company in the private sector being foreign-owned.

The following sections describe the reforms initiated by the Government in the late 1980s that caused the New Zealand media to become one of the most deregulated in the world, and how this deregulation has affected our mass media environment today.

*5.1.3.1. Deregulation and public service broadcasting*

TVNZ was never a public broadcaster in the true sense of non-advertisers such as the BBC in Britain or PBS in the United States, because of the high costs associated with broadcasting in New Zealand to such a small population size and over hilly topography (Horrocks 1996). However, even though it did not have as many resources as some overseas broadcasters, TVNZ still had a strong public service ethos and devoted significant resources to local programming up until the 1980s. It was the reforms of this period that turned TVNZ into the commercial enterprise that it is today.

In 1988, a period when many government agencies were being privatised and sold off, the public broadcaster, the Broadcasting Corporation of New Zealand, was replaced with two commercially focused State-Owned Enterprises (SOEs) called Radio New Zealand Ltd and Television New Zealand Ltd. The markets were opened for competition and in 1989 TV3 became the first private competitor in the television market. TVNZ was forced to respond, since as an SOE, it was charged with being a commercially successful business and returning a dividend to the government. TVNZ soon turned into a "cash cow" for the government (Norris and Pauling 1999), and between 1990 and 2001, it produced a dividend of $366 million for the government (TVNZ 2001).

Moreover, although TVNZ was now required to produce a surplus, it was not required to do much else. Public broadcasters in almost all other countries have detailed charters, legislation, quotas or licensing requirements that call for specific programming. In contrast, TVNZ had no legal regulations, quotas or a charter that required it to produce certain types of programmes (e.g. local or public service content).

Instead, the Broadcasting Act 1989 established a funding agency called NZ On Air, whose role was to provide public broadcasting programming in an otherwise completely commercial market. Its aim was to fund local content that would not otherwise be produced by commercial broadcasters. Te Mangai Paho, a Maori broadcasting funding agency created in 1993 to promote Maori language and culture, also had a clear programming mandate. However, the programming restrictions on these funding bodies had little effect on content that was actually aired on TVNZ, because broadcasters had no obligations to actually screen programmes that were produced. Thus, NZ on Air encouraged the production of local content, but the actual screening of those programmes was still governed by market forces, because broadcasters could choose to air only those programmes that they thought would be commercially successful.

Drastic changes were also taking place in radio during this time. The Radio Communications Act of 1989 established a market-based system for spectrum management with up to 20-year tradable spectrum access rights. This meant that frequencies were sold off to the highest bidder without any content requirements. This led to a substantial increase in the number of registered radio frequencies so that New Zealand now has more radio stations than most countries in the world. In 1987, 64 commercial radio stations were broadcasting in New Zealand. By 1996, there were about 167 commercial stations (Zanker 1996). In 1995, Auckland – a city of just over one million people – had 25 commercial radio stations, more than London and Sydney combined (Comrie 2000). Unfortunately, this proliferation has not led to a concomitant increase in the diversity of programming because of the homogenising influence of a drive for profits in a highly commercial market and because of the concentration of media ownership (Hutchison and Lealand 1996).

#### *5.1.3.2. Deregulation and foreign ownership*

The News Media Ownership Act of 1965 once restricted foreign ownership of news media here, but this law was repealed ten years later to remove all restrictions on foreign ownership of print media and to allow foreign ownership at 15% for television and 25% for radio. Then, in 1989, TV3 was introduced as the first private competitor in the television market and within six months it went into receivership. The Government, desperate for a foreign rescue bid, introduced legislation to raise foreign ownership of television and radio to 49% and then completely removed all restrictions on overseas ownership in 1991 with almost no public discussion (Norris 2002). Today, TV3 remains the only significant free-to-air, private competitor to state-owned TVNZ, and it is owned entirely by CanWest Global Communications, a Canadian company which also owns TV4.

Until recently, Independent Newspapers Limited (INL), 49% owned by Rupert Murdoch's News Corporation, was one of the two major international corporations that together controlled over 90% of the circulation in the metropolitan, provincial and Sunday newspaper market in New Zealand. INL on its own controlled 64% of this circulation (New Zealand Audit Bureau of Circulations 2003). The company owned three of the five metropolitan newspapers in New Zealand (then two of four with the merger of the *Dominion* and *Evening Post*), as well as the two national Sunday papers, one-third of the 24 provincial papers and many community papers. In April 2003, INL announced the sale of its New Zealand print assets to the Australian company Fairfax New Zealand Holdings Ltd, although it retained its holdings in SkyTV.

The second major print conglomerate in New Zealand is Wilson & Horton, which is owned ultimately by Tony O'Reilly, the Irish owner of Independent News and Media. Wilson & Horton controls 29% of the circulation for the metropolitan, provincial and Sunday print market (New Zealand Audit Bureau of Circulations 2003). It owns *The New Zealand Herald* (the largest New Zealand daily) as well as eight provincials and the *NZ Women's Weekly*, one of the most widely read magazines in New Zealand.

Few newspapers have managed to escape the grasp of these two media giants. By 2001, only one metropolitan paper (the *Otago Daily Times*) and one-third of provincials remained independent (McGregor and Comrie 2002). All of these papers except the *ODT* have circulations of less than 10,000. On the other hand, both of the New Zealand business weeklies are still New Zealand-owned and recently a number of independent local newspapers have begun to spring up around the country (Comrie 2000).

Radio in New Zealand is a similar story to print, with two mostly foreign-owned networks controlling 90% of the commercial market. The Radio Network (TRN) has the largest number of stations, many of them bought when RNZ sold off its commercial stations in 1995. TRN is two-thirds owned by Tony O'Reilly's Independent News and Media and one-third owned by American Clear Channel. The other large radio network is CanWest Radio, owned by CanWest Global (the same Canadian company that owns TV3). This network owns a number of popular networks including More FM, Channel Z, The Edge and Radio Pacific stations.

*5.1.3.3. The impact of deregulation on NZ news today*

The most significant effect of deregulation and the consolidation of ownership on New Zealand media has been an increased demand for news organisations to cut costs and improve profits in a competitive, market-driven environment. This commercial imperative has resulted in a completely different "mediascape" from the one that existed in New Zealand twenty years ago (Hutchison and Lealand 1996).

The most obvious impact has been changes in the number and type of news organisations in New Zealand. As mentioned above, the number of radio stations has increased dramatically since the 1980s, but many print companies and titles have been eliminated due to increased competition and ownership consolidation. Just in the last fifteen years, several provincials, three metropolitan papers (*Auckland Star*, *Auckland Sun* and *Evening Post*) and a Sunday paper (Comrie 2000) have been lost. All towns and cities in New Zealand have been left with only one daily paper – even Auckland, the country's largest news market. Possibly as a consequence of this decrease in diversity and changes due to increased commercialisation, readership has also declined for many newspapers (Norris 2002).

Hope (1996, p. 28) believes that the result of commercialisation on New Zealand news has been that "entertainment rather than public reasoning became the favoured rhetoric of communication." This has led to a number of changes in the format and content of news, particularly the shortening of news stories. For example, Morning Report, the flagship news programme on National Radio, was reformatted and as a result live interviews went from an average of six per programme to 16-18 per programme (Zanker 1996). Similarly, Atkinson (1994) conducted a content analysis of television news and showed a decline in item length and an increasing number of brief "sound bites" from 1985-1992.

Atkinson (1994) found that the emphasis in news has shifted since deregulation from politics, economics and industrial relations to crime, human interest and natural disaster. Horrocks (1996) also suggests that television coverage in New Zealand since 1988 has increasingly emphasised human interest and emotional impact, while rejecting programming considered to be dry or "highbrow".

The pressure to cut costs has also forced news organisations to grab news from the cheapest source available. Thus, chains of papers owned by the same big company can easily share stories amongst themselves, resulting in a net loss in the diversity of news for consumers. It is also more expensive to produce New Zealand stories than to grab overseas news from wire services, syndicates or large broadcast networks in the United States and Britain that "dump" programmes for as little as one-tenth the cost of locally made productions (Norris and Pauling 1999).

Similarly, local content in broadcast programming is also lower in New Zealand than in almost all other countries, because there are no content requirements even on TVNZ programming. Norris and Pauling (1999) found that just 24% of New Zealand television programming is local content, the lowest of 11 countries studied. Australia had a quota requiring 55% local content, and even small countries such as Ireland (41%) and South Africa (48%) achieve higher levels than New Zealand (Norris and Pauling 1999). However, a report funded by NZ on Air (2002) found that local content programming on New Zealand television has fluctuated between 19-32% since deregulation in 1988.

Another effect of cost-cutting and the drive for profits has been the loss of jobs in many news organisations. For example, before Radio New Zealand sold its commercial stations in 1995, RNZ News had its own reporters in many small towns throughout the country. However, these positions were eliminated in the transition (Norris 2002) and today their news and current affairs staff are one-tenth of their numbers in the mid-

1980s (Comrie 2000). Norris (2002) believes that this decrease in reporters has led to a loss of local contacts and expertise and that now "news gathering is reactive and done on the phone from the centralized newsroom" (Norris 2002, p. 48). Likewise, Comrie (2000) suggests that the reporters who were lost were mostly experienced journalists who could not cope with the new "infotainment" approach. Thus news organisations have been left with a cadre of young, relatively inexperienced journalists who Maharey (1992, p. 98) believes "have to rely on what they are told because they do not have the personal knowledge to ask questions."

Finally, Hope (1996) argues that the concentration of press ownership and deregulation have decreased the resources available for critical investigative reporting, and says that with lower staffing and fewer resources for gathering and reporting the news, journalists are now stretched to their limits and are forced to depend even more on primary news sources.

### 5.1.4. A crisis of faith: The NZ media today

According to McGregor and Comrie (2002, p. 7), the commercialisation, consolidation and deregulation of New Zealand media over the last two decades has generated serious dilemmas for the New Zealand media today:

> Journalism in New Zealand is working through a crisis of faith. There is justified criticism by journalists, commentators, politicians and the public about the state of the news. The news has tumbled as a means of information and education and there is declining public belief in its integrity. Driven by all-consuming forces of commercialism, a terrible hybridisation of news characterised by superficiality and sloppiness has knocked the stuffing out of journalism.

The most obvious response to this "crisis of faith" has been the decision by the Labour Coalition Government in 1999 to revise TVNZ's charter to serve public interests rather than only pursuing a commercial profit. This charter was finally written in 2002, but it remains unclear exactly what effect this new charter will have on news content and programming. There is considerable debate over whether it is possible for TVNZ to fulfil its mixed objectives of producing a profit and serving public interests at the same time (Clifton 2003).

Perhaps one of the most important changes that will need to be made is to increase the opportunities for critical thinking about the media in New Zealand. There is no regular professional forum for journalists to discuss and debate issues in New Zealand, and McGregor and Comrie (2002, p. 9) suggest that "New Zealand is perhaps unique amongst Western developed nations for its poor tradition of criticism and debate." Encouraging such critical debate may be the first step toward improving media performance and restoring public confidence in New Zealand's news organisations.

### 5.1.5. Goals of this content analysis

So far this chapter has discussed the New Zealand media environment within which science reporting operates. In particular, the deregulation of the mass media in the 1980s has resulted in a largely foreign-owned media and a highly competitive and commercial environment with few incentives for public service. This has implications for science reporting, because Comrie (2000, p.13) suggests that the deregulated media environment may be the root cause of the media's failure to "ask simple questions, exhibit normal journalistic scepticism and to take basic reality checks" in cases such as the Lyprinol incident. Moreover, in such a deregulated environment, it is difficult for specialty reporting of any kind to flourish. Chapter 4 showed that, indeed, few mass media journalists in New Zealand have a dedicated science round. Thus, we might predict that little science news would be produced in New Zealand, and that the type of news coverage found in the Lyprinol and Corngate cases might in fact be relatively common.

Thus, the purpose of this content analysis was to study broad patterns in New Zealand mass media coverage of science to characterise science news generally and also to determine how representative the Lyprinol and Corngate cases are of overall science news reporting in New Zealand. In particular, I was interested in whether news items contained evidence of independent verification, and also what strategies were used to present controversial scientific claims. I was also interested in whether the length of a news item influenced other content factors (e.g. the number of sources or the amount of contextual information). These patterns were also compared to how surveyed journalists said they reported scientific claims (see Chapter 4), and any differences or outstanding behaviours were explored further in open-ended interviews with the journalists (see Chapter 6).

## 5.2. Methods

### 5.2.1. Why content analysis?

Content analysis is a popular research method used across the social sciences, but researchers in the fields of communication and cultural studies have used it most frequently. It is regularly used in agenda-setting research in particular (see Dearing and Rogers 1996), to establish the issues that are dominant in media coverage and to compare that to public perceptions (through surveys, for example). A number of studies of science news have employed content analysis to investigate various aspects of science reporting in newspapers (e.g. Cole 1975; Caudill 1987; Caudill 1989; Hinkle and Elliott 1989; Evans et al. 1990; Pellechia 1997; Logan et al. 2000b;2000a).

Berelson (1952, p. 147) defined content analysis as a "research technique for the objective, systematic and quantitative description of the manifest content of communication." Today, it is widely recognized that content analysis is not value-free or objective because arbitrary decisions are made at all stages of the process (Deacon et al. 1999). However, being quantitative, it is replicable and systematic (Hansen et al. 1998), which makes it an effective method for detecting trends, patterns and absences in large amounts of text (Deacon et al. 1999). Early definitions also focused on the frequency of symbols in a text, but modern approaches also look at the relationships between symbols at the analysis and interpretation phase (Hansen et al. 1998). Another advantage of content analysis is that it can measure people's behaviour, i.e. what people have actually done rather than what they say they do (Berger 2000).

Content analysis is not a suitable method for studying the detailed meanings of symbols within texts, nor can it indicate the relative impact that the identified content patterns might have on audiences (Hansen et al. 1998). For example, Mazur (1981) found that an increase in media coverage of a scientific controversy led to an increase in opposition to the controversy, regardless of whether the coverage was negative or positive.

### 5.2.2. Experimental design for this study

A sample of four weeks was constructed from a one-year period (June 15, 2000 – June 15, 2001) by randomly selecting a starting date and then sampling every thirteenth day (Krippendorff 1980). On each sample day, a single coder (the author) read all of the news in 23 of New Zealand's daily newspapers (including the five metropolitan newspapers and 18 of the 20 provincial daily newspapers, omitting two small community tabloids). Five of the smaller newspapers were not published on Saturdays, and on Sundays, only the two national Sunday papers (*Sunday Star-Times* and *Sunday News*) were analysed. The newspapers were searched manually, since no reliable electronic database of New Zealand news existed at the time of this study.

On sample days, the coder also recorded news, current affairs shows and documentaries on two national television stations (TV ONE and TV3) and the national public radio station (National Radio). Potential science stories were first identified using the Newztel monitoring service, which provides summaries of most broadcast news. These potential stories were then viewed to determine which of them fit into the study's definition of 'scientific claims'.

The coder saved copies of all print and broadcast stories that focused on a scientific claim, which was operationally defined as a claim with an implicit or explicit hypothesis that could be supported or refuted with scientific evidence. Editorials, other opinion pieces, obituaries, advertisements, articles about science fairs and prizes and book reviews were not included in the sample.

As the stories were collected, the coder answered a series of questions for each story (see Appendix 2). Characteristics of the news items were recorded including length, author, format (news, feature, broadcast news, programme, or documentary) and topic. Length was measured in number of sentences for print articles and in seconds for broadcast articles. Although print articles are frequently measured in column inches for content analysis (see Pellechia 1997), sentences were counted in this study to standardise lengths across different formats. In addition to these characteristics, the following questions were coded for:

- *How many independent sources are mentioned in the news items?* Sources were considered independent as long as they were not identified as belonging to the same research group, which was considered a generous operational definition of 'independent'. Both scientific and non-scientific sources were counted.
- *How many different views about the scientific claim are given?*
- *Is there any evidence that the journalist has attempted to independently verify the scientific claim?* Evidence for verification included references to sources that commented on the claim, written documents, internet sites, scientific literature and other media accounts related to the claim. Again, this was considered a generous operational definition of 'independent verification'.
- *Has the research discussed in the news item been peer reviewed?*
- *Is the claim maverick science?* Maverick science was defined as "unorthodox scientific theory which is believed as credible by only one or a few scientists" (sensu Dearing 1995).
- *Does the news item contain polarised controversy?* Polarised controversy was operationally defined as presentation of two or more truth claims in direct conflict or opposition.
- *In news items with more than one opinion, is the spectrum of scientific opinion or the scientific consensus discussed?*
- *In news items with more than one opinion, is the weight of evidence discussed?*
- *Does the news item contain information about the methodology of the research?*
- *Does the news item discuss prior research, or what further work needs to be done?*
- *Does the news item discuss the study's limitations, qualifications and uncertainties?*
- *Does the news item explain why the claim is significant, or how it is relevant to people's lives?*

The content analysis followed the general rules and assumptions for the analysis of written document content (Holsti 1969; Deacon et al. 1999).

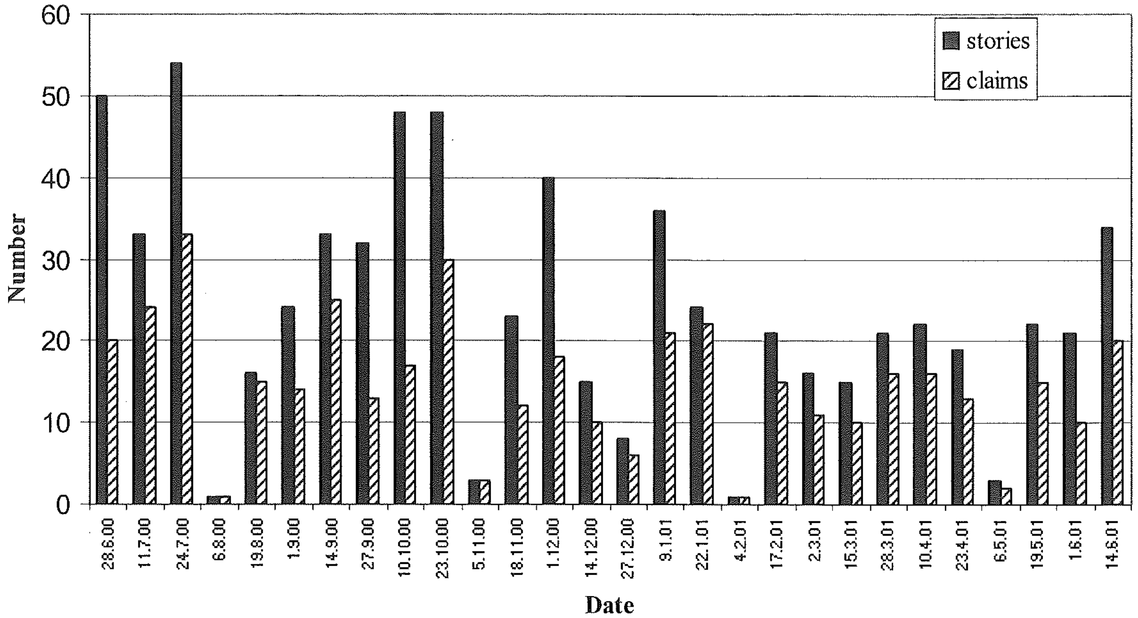
## 5.3. Results

### 5.3.1. Characteristics of the science news

A total of 682 stories containing scientific claims were collected from the four constructed week sample, or an average of 24 per sampled day. Figure 5.1 shows the distribution of those stories over the 28 days, as well as the number of claims covered by those news items each day. Between eight and 54 stories were collected each day, except for Sundays (6/8/00, 5/11/00, 4/2/01 and 6/5/01) when only two newspapers and fewer broadcast news shows were produced.

Most of the news items (90.2%) were from newspapers, while 4.2% were from National Radio and 5.6% were from TV ONE or TV3. It should be noted that only news items with a scientific *claim* (i.e. hypothesis) were sampled, so many science-related items were omitted from this sample. Thus, the 682 news items do not represent the total amount of science news covered in the New Zealand mass media.

**Figure 5.1.** The number of science stories and scientific claims that were collected from 25 New Zealand newspapers, two national television stations and one national radio station during the four constructed week sample from June 15, 2000 until June 15, 2001.




Each of the news items was classified according to the specific scientific claim discussed so that it was possible to determine the number of news items that reported on each claim. The sample contained 392 distinct claims, and 72.2% of those claims were focused on by only one news item (Fig. 5.2). Only seven claims were covered by eight or more different news organisations. This indicates that in fact a large number of distinct claims were covered in the media, rather than a smaller number of claims being covered (or repeated) by many different sources.

**Figure 5.2.** The number of claims that were covered by single or multiple stories in New Zealand newspapers and national broadcast stations within the four constructed week sample period.

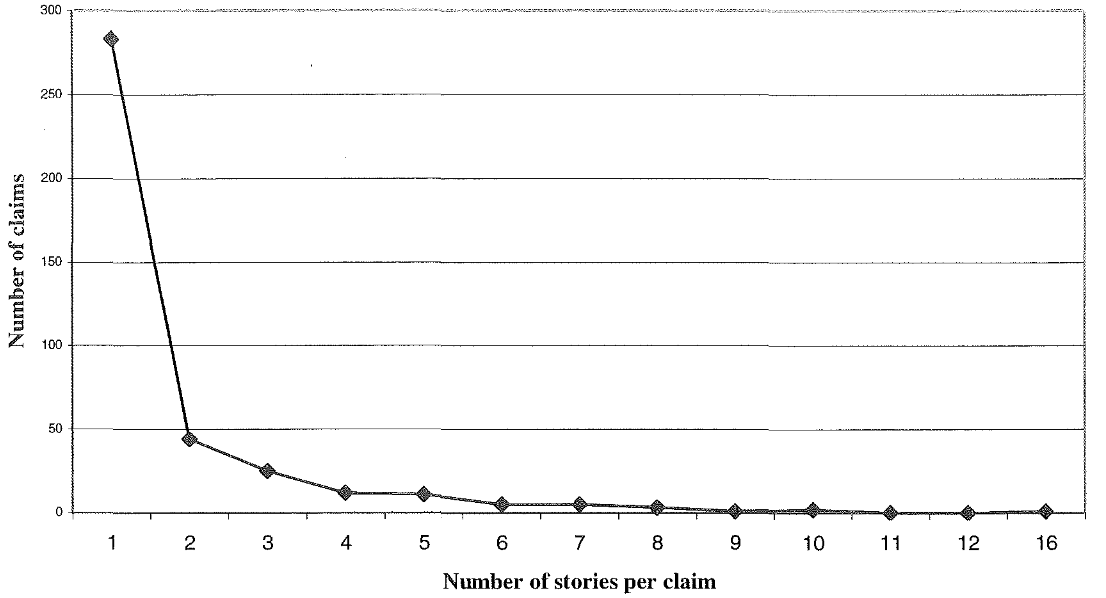



Table 5.2 shows the distribution of news items collected from each of the newspapers and broadcast stations. *The Dominion* and the *New Zealand Herald* had the most articles with science claims (n = 61 and 46 respectively). Only eight of the 18 provincial daily newspapers had less than 20 science news items (representing about one item per day) during the four constructed weeks. National Radio covered more science news items than the television stations, and TV ONE aired more scientific claims than TV3.

**Table 5.2.** The number of news items about scientific claims collected from a four constructed week sample from 23 metropolitan and provincial daily newspapers, two national Sunday papers, TV ONE, TV3 and National Radio.

| Newspaper or broadcast station | Number of news items |
|---|---|
| *The Dominion* | 61 |
| *The New Zealand Herald* | 46 |
| *The Evening Post* | 42 |
| *Evening Standard* | 38 |
| *Bay of Plenty Times* | 32 |
| *Waikato Times* | 32 |
| *The Gisborne Herald* | 30 |
| *Hawke's Bay Today* | 30 |
| *The Westport News* | 30 |
| *The Northern Advocate* | 29 |
| National Radio | 29 |
| *The Daily News* | 25 |
| *Daily Post* | 24 |
| *The Press* | 24 |
| TV ONE | 23 |
| *The Nelson Mail* | 21 |
| *Ashburton Guardian* | 20 |
| *Otago Daily Times* | 19 |
| *The Southland Times* | 19 |
| *The Marlborough Express* | 18 |
| *Wanganui Chronicle* | 18 |
| *The Timaru Herald* | 17 |
| *The Oamaru Mail* | 15 |
| TV3 | 15 |
| *The Greymouth Evening Star* | 13 |
| *West Coast Times* | 7 |
| *Sunday Star-Times* | 3 |
| *Sunday News* | 2 |

Table 5.3 shows the frequency of scientific topics covered in the sampled news items. Half of the stories (50.0%) focused on medicine and health. The other most common topics were environment/ ecology (12.8%), social science (10.7%) and genetics (8.8%). While these topics are probably popular and topical in the New Zealand mass media today, it should be noted that because only stories with scientific claims were included in the sample, the range of topics covered may or may not be representative of all science stories. For example, agricultural stories appear in the New Zealand media frequently, but most news focuses on individual farmers or agricultural products, events or business. In addition, the announcement of the mapping of the human genome on 27 June 2000 resulted in a large number of genetics stories, which might not have been represented so highly otherwise.

**Table 5.3.** The number of sampled news items categorised by the scientific topic(s) covered. Topics are listed from most frequent to least frequent. Some items focused on more than one topic so the percentages sum to more than 100%.

| Topic | Number of news items | Percentage of total news items |
|---|---|---|
| Medicine/Health | 341 | 50.0 |
| Environment | 87 | 12.8 |
| Social Sciences | 73 | 10.7 |
| Genetics | 60 | 8.8 |
| Agriculture | 42 | 6.2 |
| Climate studies | 36 | 5.3 |
| Archaeology | 23 | 3.4 |
| Astronomy | 23 | 3.4 |
| Biology | 21 | 3.1 |
| Evolution | 6 | 0.9 |
| Food science | 6 | 0.9 |
| Physics | 6 | 0.9 |
| Computers | 4 | 0.6 |
| Technology | 4 | 0.6 |
| Mathematics | 1 | 0.1 |
| Chemistry | 0 | 0 |
| Geology | 0 | 0 |

The average length for the sampled newspaper stories was 14.0 sentences, and 20.7% were five sentences or shorter. The average broadcast length was 3.6 minutes. For print and broadcast news combined, most items (90.5%) were 'hard news' stories. Only 7.3% were feature articles and 2.2% were broadcast current affairs pieces. Only 4.3% of the newspaper articles appeared on the front page.

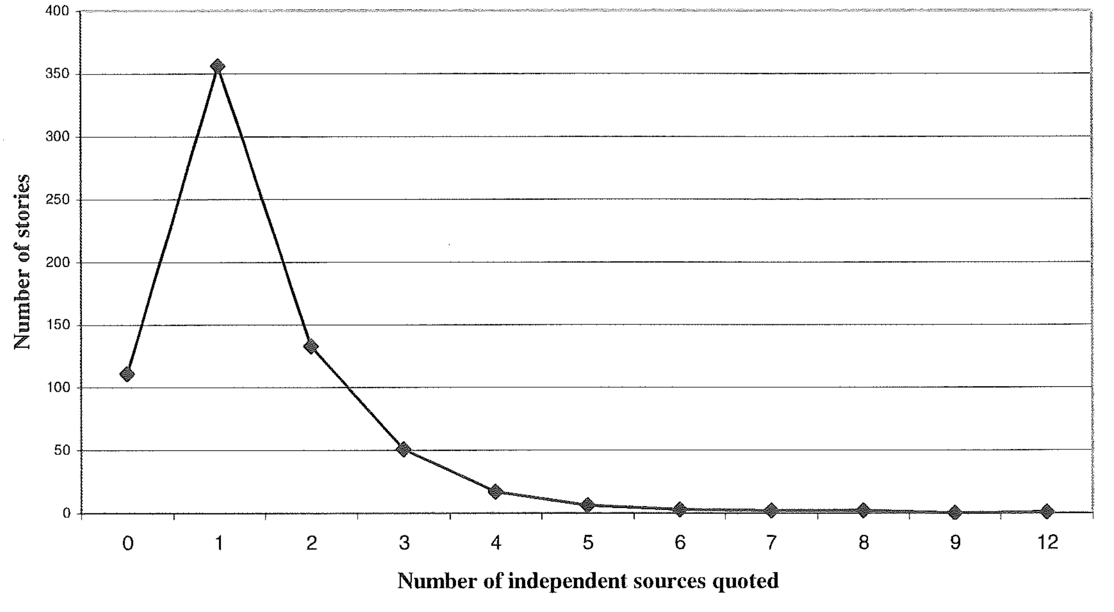
The majority of the news items (64.5%) originated from an overseas news organisation or wire service (e.g., Reuters, AAP, AP, AFP, *The Times*, *Observer*, etc). Only 20.2% of the news items included NZPA in the by-line, and only 15.5% of the items included a staff reporter in the by-line. Almost three-quarters of the sampled items (72.0%) had an international focus (operationally defined as discussing a claim made by an overseas scientist without comment from New Zealand scientists and without any discussion of the relevance or importance of the claim for New Zealanders). Just 28.0% had a New Zealand focus, including only 4.0% that had a local or regional angle.

### 5.3.2. Verification

Figure 5.3 shows the distribution of the number of sources cited in each news item. Scientists within a research group were counted as a single source. In the majority of the news items sampled, it did not appear that the journalist independently verified the scientific claim presented with a second source. Only 31.5% of the stories cited more than one source (including both scientists and non-scientists). Just 14.2% of the stories included more than one view of the scientific claim. This means that in 54.9% of the 215 stories with more than one source, the sources corroborated each other's claims rather than expressing different views.

Only 24.3% of the stories showed explicitly that the journalist had independently verified the claim either through a second source or through other documents, scientific literature, the internet or other media accounts. This percentage is lower than the percentage of stories with more than one source, because in some cases, sources were clearly used for other purposes besides verification. Print news items that were verified were significantly longer (mean = 21.8 sentences) than stories that were not verified (mean = 11.7 sentences; $T = 9.93$, $df = 613$, $p < 0.001$). Only four of the 127 print articles that were five sentences or less contained evidence of independent verification. Features were also significantly more likely to be verified than news ($\chi^2 = 15.82$, df = 1, $p < 0.001$). However, broadcast stories that were verified were not significantly longer (mean = 4.4 minutes) than broadcast stories that were not verified (mean = 3.2 minutes, T = 1.04, df = 65, p = 0.152).

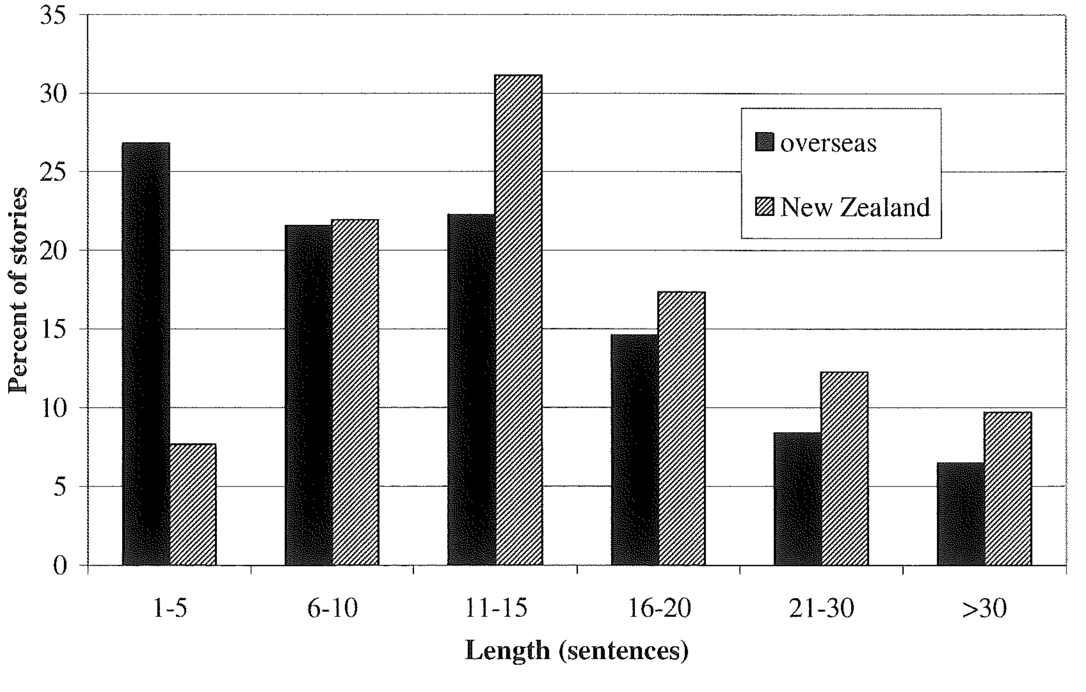
**Figure 5.3.** The number of sources referred to in each science news item from the New Zealand mass media during the four constructed week sample.




Whether the story was peer reviewed was significantly related to whether the story was independently verified ($\chi^2 = 19.37$, df = 2, p = 0.0001). However, this was primarily due to the large number of stories that did not say whether the research was peer reviewed or not, most of which were not verified. Only 21.6% of the items stated that the research had been peer reviewed and 32.4% explicitly said that the research had not been peer reviewed, while 46.0% of the items did not say whether the research had been peer reviewed or not. When the latter stories were removed from the sample, claims that had been peer reviewed were not less likely to have been verified than claims that had not been peer reviewed ($\chi^2 = 2.52$, df = 1, p = 0.11).

Print items that were produced within New Zealand were significantly more likely to have more than one source than print items produced overseas ($\chi^2 = 27.98$, df = 1, $p < 0.001$). This may have been related to the fact that New Zealand print articles were significantly longer on average than overseas print articles (T = -3.23, df = 613, p = 0.001). Although the mean lengths were relatively similar (mean = 13.1 sentences for overseas articles and mean = 16.2 sentences for New Zealand articles), 26.8% of the overseas articles were five sentences or less, compared to just 7.7% of New Zealand articles (Fig. 5.4). Nonetheless, because the sample contained more overseas stories than New Zealand stories, the overseas articles contributed 63% of the total sentences, which is similar to its contribution of 65% to the total number of items.

**Figure 5.4.** The percentage of newspaper articles from overseas sources and from New Zealand sources in different length categories. Item length was measured in sentences and the percentages shown are for the total number of overseas (n = 418) *or* New Zealand stories (n = 196), not for the combined total.




Of the 682 news items with scientific claims, 64.2% cited scientists or research groups who were directly involved with research about the claim. Almost one quarter (21.1%) of the news items cited scientists who were not directly involved in the research but who had relevant credentials. Only 2.2% of the items cited scientists whose credentials were either not relevant or not specified, and three of these stories did not cite any additional scientists whose credentials were known to be relevant to the claim at hand. One quarter (27.9%) of the stories cited one or more non-scientists, and 8.9% of the news items cited only non-scientists and no scientists.

### 5.3.3. Presentation of scientific evidence and contextual information

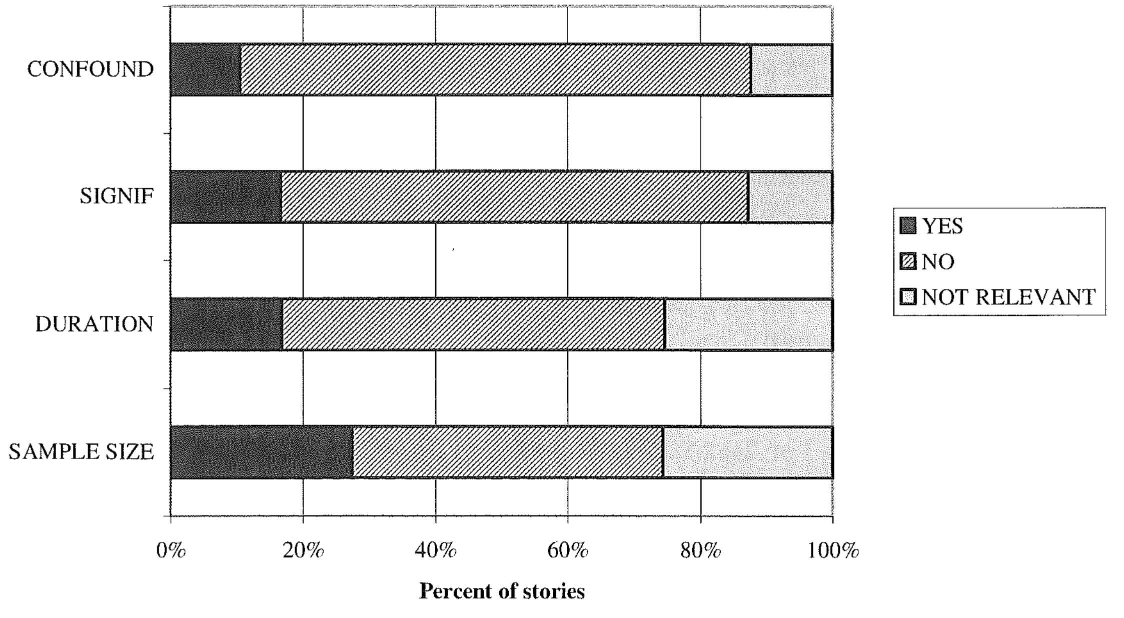
The majority of the sampled news items (82.3%) did not refer to specific scientific evidence or data to back up the scientific claim presented. To estimate how much of each news item referred to scientific data compared to anecdotal evidence, the total number of sentences that were either supportive or critical of the scientific claim were counted, and the percentage of those sentences that discussed either scientific data or anecdotal evidence were calculated. For newspaper articles, data sentences (36.0%) significantly outnumbered anecdotal sentences (7.0%; $F = 2.75$, $df = 1, 613$, $p < 0.001$).

Less than half of the sampled news items (39.4%) gave any explanation of the methodology of the research supporting the claim. In stories where it was relevant to include the sample size or the duration of the study, 36.9% included the sample size and 22.6% included the duration (Fig. 5.5). The probability or statistical significance of the results were discussed in just 19.2% of the stories where it was relevant, and potential bias or confounding factors were mentioned in only 12.0% of the stories that could have included such information.

Less than half (41.6%) of the news items sampled provided any information about prior research on the scientific claim discussed, and 32.1% gave any information about future work or unanswered questions related to the claim. Only 19.9% of the items identified what needed to be done to further establish the truth of the claim, despite the fact that 52.9% of the claims were classified by the coder as "emergent" science (operationally defined as claims that were preliminary, tentative, unconfirmed by extensive testing, or without replication or confirmation by other research findings; sensu Logan et al. 2000b). Only 10.1% of the news items mentioned potential vested interests that could have influenced the claim or scientific evidence.

Only 35.5% of the news items discussed limitations that might qualify the scientific claim. Similarly, 58.5% of the stories presented the scientific claim as being very certain, with no qualifications, controversy or other perspectives discussed. In 38.6% of the stories, the coder could identify important limitations, qualifications or controversy that the author failed to mention (usually from other articles on the same topic). The coder identified only 16 stories (2.3%) that overestimated the uncertainty of a claim (i.e. discussed controversy surrounding a claim that was well-established and accepted by most mainstream scientists). The most common type of uncertainty discussed in stories was insufficient data (including the need to confirm or replicate the data, or the need for more time for testing or development; 22.1% of stories).

**Figure 5.5.** The percentage of news items that contained any information about the sample size, duration, statistical significance or confounding factors of the research discussed.




The number of sentences in each newspaper article that discussed prior research, future research, methodology or limitations all significantly increased as the length of the article increased (Table 5.4). Moreover, the percentage of sentences discussing prior research, future research and methodology increased significantly with length, showing that in longer articles, journalists were more likely to include contextual information. The percentage of sentences discussing limitations also increased with length but not significantly.

However, each of these effects was small, as shown by the small $R^2$ values in Table 5.4, and the number of sentences discussing each type of contextual information increased only slightly even in very long articles. For example, the regression line between story length (in sentences) and the number of sentences discussing methodology predicted a fitted value of 1.7 sentences even when the total article length was 50 sentences. For future research and for limitations, the fitted values were each 2 sentences for articles 50 sentences long. The fitted value for prior research was slightly higher at 4 sentences for stories 50 sentences long.

While many stories did not discuss the background, methods, or limitations of the research, more than two-thirds of the print and broadcast stories (76.8%) gave some explanation of why the claim was important, how it could be applied, or how it was relevant to people's lives.

**Table 5.4.** Number and percentage of print news items sampled that contained information about the research methodology, prior research on the claim, future research on the claim, the importance or relevance of the research, or limitations and qualifications to the claim. The total sample was 615 news items. Regression values are given for the relationship between the number of sentences of each type of information and the total number of sentences in the article, and between the percent of story sentences of each type of contextual information and the total number of sentences. Df = (1, N – 2) in all cases.

| | News items | | No. vs. length | | | % vs. length | | |
|---|---|---|---|---|---|---|---|---|
| | % | N | $R^2$ | F | P | $R^2$ | F | P |
| Methodology | 40.5 | 249 | 0.06 | 36.66 | p<0.001 | 0.009 | 5.84 | p = 0.016 |
| Prior research | 41.5 | 255 | 0.24 | 194.82 | p<0.001 | 0.01 | 6.12 | p = 0.014 |
| Future research | 31.1 | 191 | 0.13 | 91.88 | p<0.001 | 0.01 | 5.96 | p = 0.015 |
| Limitations | 34.6 | 213 | 0.13 | 93.45 | p<0.001 | 0.004 | 2.58 | p = 0.109 |

### 5.3.4. Maverick science

Maverick science was uncommon in this sample, accounting for only 2% of the news items (13 items). Only one of these maverick claims was independently verified in the news item. This article, which discussed a psychologist's claim that spirit mediums have paranormal powers, contained four sources, one of which rejected the claim. It mentioned that some of the research had been peer reviewed, but the article also polarised the two different views and it did not contain any information about the spectrum of scientific opinion on the issue, nor any analysis of the relative evidence for and against each side.

None of the remaining twelve maverick stories was verified and all contained only one source and no views that were critical of the claim. Only two of the stories mentioned that the research backing the claim had not been peer reviewed. None of the stories discussed either the scientific evidence for and against the claim, or the spectrum of scientific opinion about the claim.

### 5.3.5. Balance

As mentioned above, only 14.2% of the news items ($n = 97$) included more than one view of the scientific claim. In other words, the media rarely presented scientific claims as contested either by other scientists or by non-scientists. Of these 97 stories, 56.7% polarised the controversy by presenting two views in direct conflict or opposition. Only five of the news items included any discussion of the spectrum of scientific opinion regarding the claim, and 24 items (24.7%) discussed the relative evidence for and against the claim.

Of the 24 news items that discussed the 'weight-of-evidence', only one included an overall evaluation of which claim was most likely to be true given the available evidence. Only one of the 24 news items was a broadcast piece (radio), and 37.5% of the print articles were features. The print articles that discussed the weight of evidence were significantly longer (mean = 28.3 sentences) than print articles without the weight of evidence (mean = 13.5 sentences; $T = -6.29$, $df = 613$, $p < 0.001$). Nine of the news items (37.5%) were produced in New Zealand, and the remaining fifteen were produced overseas.

## 5.4. Discussion

### 5.4.1. Science content in the New Zealand mass media

This content analysis resulted in 682 news items with scientific claims over the 28-day sample period. It is difficult to compare total amounts of science coverage across studies, because different researchers use different sampling and collection techniques; they operationalise categories such as 'science' in different ways; and newspapers and networks have different circulations and geographic coverage. However, some rough comparisons suggest that the amount of science news in New Zealand is not considerably less than coverage overseas. In a study of British news in 1990, Clayton et al. (1993) found 305 and 472 science articles in *The Times* and *Guardian* respectively over a three-month period, which equates to about 100-150 stories per month. The circulation of these two publications together is over one million, which is similar to the total newspaper circulation in New Zealand (New Zealand Audit Bureau of Circulations 2003). In the United States, Pellechia (1997) found 56 science articles from her eight-day sample (one week plus one day that science sections appeared) from the time period 1986-1990 of the *New York Times*, *Chicago Tribune* and *Washington Post*. This extrapolates to just over 200 articles per month, for a combined circulation of around 2.6 million.

This comparison should not be taken as a quantitative assessment of how much science news is reported in New Zealand, but at least at a qualitative level, it does suggest that science coverage in the New Zealand media is not insubstantial compared to coverage overseas. Of course, the comparison is made more difficult by the fact that many publications in New Zealand are being compared to just a few larger publications overseas, because it is possible that in New Zealand, much of our science news results from articles being reprinted in different publications. However, the number of claims was not substantially lower than the number of news items on each sampled day, which suggests that the majority of sampled stories were unique news items. Still, the sample included only one-day snapshots per fortnight, and articles may get re-used over cycles of a few days (i.e. articles appear in different publications on subsequent days).

Half of the articles sampled were about medicine or health. Genetics and the environment were also covered frequently, while the physical sciences and mathematics were rarely covered. McGregor and Comrie (1995) also found that health news is an increasingly popular topic in broadcast news in New Zealand, as it represented 16% of all broadcast news sampled in 1994.

This emphasis on medicine and the life sciences also occurs overseas. Pellechia (1997) found that medicine and health were the most common science topics written about in American newspapers during the three periods of 1966-1970 (72% of science stories), 1976-1980 (76%) and 1986-1990 (71%). Metcalfe and Gascoigne (1995) also report that medicine and the life sciences dominated Australian science coverage in 1989 and 1993 studies, while mathematics and the physical sciences received little coverage. Similarly, medicine, biology and the environmental sciences were the most common science topics in *The Times* and were eclipsed only by computing/IT in the *Guardian* in a 1989-90 British study (Clayton et al. 1993).

All of these results accord with other studies that have noted that most journalists in countries around the world view medicine and health-related issues as the most newsworthy science topics (e.g. Meadows 1986; Hinkle and Elliott 1989; Meadows and Hancock-Beaulieu 1991). This may be explained by a variety of factors, including the fact that most medical news scores high in terms of human interest and relevance to the audience and the fact that medical scientists are more likely to approach journalists than other scientists (Hansen 1994). News audiences around the world generally report the greatest interest in medical news among all science topics. Environmental news also ranks high in some countries such as Canada (Einsiedel 1992). Hipkins et al (2002) found that the scientific topics that surveyed New Zealanders had the greatest interest in were new medical techniques and treatments (81% interest) and saving endangered species (81% interest).

In addition, these fields are similar to the topics that surveyed New Zealand journalists identified as important (see Chapter 4). However, one notable deviation was that surveyed New Zealand journalists identified agriculture as one of the top fields that was and should be covered, even though only a small proportion of news items in the content analysis were about agriculture. (Hipkins et al. (2002) also found that the New Zealand public has a strong interest in learning about agriculture.) The reason for this discrepancy between the journalists' priorities and news coverage in this case is probably that many agriculture stories were omitted from this study because they did not discuss a particular scientific claim, but rather focused on farming products, conditions or markets. Other content analysis studies have tended to either omit agricultural stories from science coverage or lump them with other biology or life sciences stories (e.g. see Pellechia 1997).

### 5.4.2. Space constraints

The average length of science news items in this study was 14 sentences for print stories and 3.6 min for broadcast pieces, which highlights the space limitations (or time limitations for broadcast media) inherent in all mass media news coverage. More disturbing is the fact that 21% of the sampled stories were news briefs (defined as items that were five sentences or less). Moreover, only 50 feature stories were sampled, which is significant because in features, journalists often have more space and editorial freedom to explore different perspectives and to give contextual information. These results are in-line with studies in other countries with little specialist science reporting. For example, Einsiedel (1992) found that about 60% of Canadian science news pieces were news briefs, typically compiled from various wire services or newspaper news services, and only 9% of the stories were features.

Space limitations have a number of potential implications for science coverage. Most importantly, journalists may leave out contextual information, they may fail to verify the claims they report and they may choose a balancing strategy to report controversial claims.

*5.4.2.1. Lack of contextual information*

One potential effect of space limitations is that journalists may leave out contextual information that might help the audience interpret the scientific claims described. In this sample, less than 20% of the news items identified what needed to be done to further establish the hypothesis. Only one-third of the stories mentioned future work related to the hypothesis. Information about the methodology, probability, confounding factors, and prior research – all of which could help the reader evaluate the scientific claim – were omitted completely in the majority of stories. Limitations or qualifications were similarly discussed in less than half of the stories, making many of the claims appear more certain than they probably were.

Numerous studies have found that journalistic accounts of science tend to contain less information than scientific accounts about related research, the process by which the science was conducted, and about the limitations of the study. For example, Weiss and Singer (1988) found that media coverage of the social sciences tended to make findings seem more certain than scientists believed them to be by omitting caveats and the results of previous research. Similarly, Fahnestock (1993) compared stories in *Science* magazine to popular articles on the same topics and found that the popularised versions omitted or downplayed qualifiers and caveats presented in *Science*.

Pellechia (1997) also found that less than half of American newspaper science stories mentioned limitations, presented prior research on the topic discussed, or had methodological descriptions of 30 words or more. Tankard and Ryan (1974) found that surveyed scientists said that the omission of information about methodology was the most serious problem of science reporting, and Singer (1990) found that almost half of the articles studied had no mention of the research methods. Einsidel (1992) found that among Canadian science stories where methodological information would have been appropriate, three-quarters did not have such details.

Limited space is one potential reason that contextual information is often limited. Einsiedel (1992) found that contextual information was more common in longer science stories in the Canadian press. Similarly, in this study, length seemed to be important. Few journalists could be expected to provide contextual information if given only five sentences in which to convey the entire story, and one-fifth of the news items sampled here were this short. Longer items did tend to have significantly more contextual information (i.e. information about the study limitations, methodology, prior research and what work was left to be done) than shorter stories. However, even very long items usually contained no more than a few sentences of such information.

An alternative explanation is that journalistic routines work against the inclusion of contextual information. Qualifications and contextual information do not add to the news value of a story – and in fact they may well detract from it. Journalists must establish the significance, novelty and relevance of the claim to their audience, and caveats may just distract from these values (Rowan 1989; Fahnestock 1993; Pellechia 1997). Pellechia (1997, p. 62) suggests that it is "easier to convey the newsworthiness or uniqueness of a particular finding if it is cast as a breakthrough or isolated event, rather than if it is contextualised as part of a larger body of research." Furthermore, journalists need extra time (that they usually do not have) to learn about the context of a study, which may involve wading through technical papers that they do not have the scientific expertise to understand.

Why might it be important to include contextual information about prior findings, the methodology of the research and limitations to the study? Such information may help the audience interpret the generalisability of the study and make informed decisions, particularly about whether the results merit behavioural change. Other scholars have suggested that a focus on 'breakthroughs' without a context of studies that have come before can give the public the wrong impression of how the scientific process works by ignoring the cumulative nature of scientific research (Millar and Wynne 1988; Nelkin 1995). For example, Klaidman (1990, p. 124) suggests that:

> Stories about the progress of medical research often lurch from journal article to journal article conveying no sense of long-term trends and leaving intelligent nonspecialist readers in a poor position to evaluate whether certain chemicals constitute a threat to their health.

Concern over the lack of context in science stories is widespread in the science communication literature, but the empirical evidence about what audiences do with contextual information in science news is mixed. Rogers (1999) found that focus group participants who read or viewed news stories about AIDS and global warming said that insufficient information and a lack of context were important factors that limited their understanding of the scientific issues. Likewise, Corbett et al (2002) found that the inclusion of contextual information in global warming stories made readers more certain of global warming than if that context was not given.

In contrast, a study by Mosier and Ahlgren (1981) looked at the effect of adding methodological details to media stories and found that readers, regardless of education, did not judge the stories to be more clear, accurate or trustworthy than matched stories without the details. Similarly, Lordan (1993) found that the inclusion of methodological details did not help readers understand news stories, and Gorchow (1990) suggests that readers may not understand the implications of phrases such as 'preliminary' and 'early results'.

#### *5.4.2.2. Lack of verification*

A second potential effect of space constraints may be a limit on the number of sources that journalists are able (or feel the need) to quote. In this study, only 24% of stories showed evidence of independent verification. News items that were independently verified were significantly longer than one-source stories. Potential reasons for this difference are that journalists spend less time on short stories, or that they do not think that short stories require multiple sources. In addition, editors may eliminate different perspectives when shortening stories, particularly when long stories from a wire service are shortened to briefs of just five sentences. The overseas news items in this study were significantly shorter than the New Zealand stories, and they were significantly less likely to contain multiple sources.

#### *5.4.2.3. The balancing strategy*

A third potential effect of space constraints is that when faced with a controversial or contested claim, journalists could be forced to present a balanced approach rather than explaining the weight of evidence for each side. The number of news items in this sample that did explain the weight of evidence was too small to explore a relationship with story length. However, given that news items with multiple perspectives were more likely to be longer anyway, space is unlikely to have been a significant constraint. It is more likely that balance is the preferred strategy for reasons related to the professional routines, values and norms of journalism. These will be explored in more depth in Chapter 6.

### 5.4.3. The importation of science news

In this content analysis, 65% of the science news items were imported from overseas news organisations and wire services, which is high compared to the proportion of foreign-authored science coverage in some other countries. For example, the *Sydney Morning Herald* received only 23% of its science stories from overseas and *The Australian* 36% in a 1991 Australian study (Metcalfe and Gascoigne 1995). A recent content analysis of 15 South African newspapers found that 38% of science stories had foreign authors (van Rooyen 2002). However, the Canadian press seem to rely on wire services to a similar extent as the New Zealand media. Einsiedel (1992) found that almost half of Canadian newspaper science stories originated from foreign wire services.

There are two potential explanations for the lack of local science content in New Zealand. First, this study only included news items with scientific claims and excluded science news about, for example, science fairs and prizes and profiles of notable scientists. These topics are likely to be primarily local content, and so New Zealand journalists who cover science may devote the majority of their science coverage to these "event-driven" topics, which require less time and in-depth research to cover. Numerous authors have argued that journalists prefer 'events' to cumulative scientific research or issues that require a longer-term approach (Caudill 1987; Dunwoody and Griffin 1993; Detjen 1995; Pellechia 1997).

Second, the preponderance of overseas science content may be explained by a range of other factors that make international news more desirable than local news to New Zealand media organisations. Most importantly, it is cheaper and easier for news organisations to get satellite-fed and news agency news than to produce their own, particularly for complex topics such as science. Accordingly, the recent increase in access to overseas news has meant that all New Zealand news now has less local content (Norris and Pauling 1999; Norris 2002).

Science may be a particularly extreme example, because of the lack of specialised science reporters and science rounds in New Zealand (see Chapter 4). Science news from overseas publications and wires is also appealing to news organisations because it is usually based on peer reviewed journals or on well-known, credible institutions that do not need cross-checking. This creates a paradox whereby journalists may take pride and see news value in 'home-grown' research, but find it far easier to report science done in Europe, Britain and the United States.

The importation of so much overseas science news may have a number of potential ramifications for science content in the New Zealand mass media. First, New Zealanders will be exposed to less scientific research that is conducted in their own country than to science conducted overseas. It is difficult to know how this might influence public perceptions of science, but it has the potential to suggest both that little science is produced in New Zealand, and that New Zealand science is less significant, interesting or important than science produced overseas. The lack of local content may also make it difficult for New Zealanders to understand how scientific research is relevant to their own lives and how overseas studies can be interpreted within a New Zealand context. It might also mean that important New Zealand scientific research does not make it into the popular press.

Finally, the importation of science news means that New Zealand sub-editors with little or no experience in science or science reporting will be responsible for shaping – and usually shortening – much of the science content that is presented to the New Zealand public. The selection of news from wire services influences media content, because another set of news workers at the wire agency have already selected a sub-set of news stories to provide over the wire. Studies have shown that editors tend to follow the overall proportions of topics that wire services provide (Hirsch 1977; Whitney and Becker 1982).

Moreover, editors can alter overseas stories in various different ways that influence how a scientific claim is presented. One way they change stories is by shortening stories, often creating news briefs from longer feature stories. More than one quarter of the overseas news items were less than five sentences, compared to just 8% of New Zealand stories. Many of these briefs described quirky, funny or ridiculous claims without any context about the limitations or methodology of the research, or how the studies meshed with previous research (Fig. 5.6).

The coverage of a claim by a British scientist that Viagra helped ten women become pregnant illustrates how editors sometimes create news briefs by shortening longer feature articles off the wires (see Fig. 5.7). In their front page story (Fig. 5.7a), the *New Zealand Herald* reported the claim with a balancing cautionary statement that "New Zealand fertility experts are not recommending the anti-impotence drug to couples here" in the second paragraph, and a quote by a local medical director that points out the limitations of the study. In contrast, seven newspapers ran a slightly shorter version of the story from Reuters that did not include any cautionary statements, or any New Zealand sources (Fig. 5.7b). The result was a much more certain claim that relied entirely on one woman's anecdotal experience. Three additional newspapers ran only a news brief of 2-3 sentences which stripped the claim of context altogether, essentially creating a 'quirky' science story (Fig. 5.7c).

This example illustrates how this process of downloading science news from wire agencies can result in inaccuracies and omissions. Partly, this can occur because editors often have different priorities from journalists and scientists (Johnson 1963; Nelkin 1995). In addition, Einsiedel (1992, p. 79) suggests this process enables news to skip some of the "critical filters" that most news must pass through. As a result, she suggests that such material "is not reflective of the activities of the scientific process but is rather a reflection of promotional attempts by all levels secondary to scientific pursuit" (Einsiedel 1992, p. 79).

**Figure 5.6.** Some examples of 'news briefs' that were taken from overseas wire services. Such briefs lack contextual information that could help readers evaluate the claims made.

### Fat-head a good head

NEW research shows that being a fat-head may not be so bad after all. It was reported today that researchers from the University of Western Ontario had found that people with big and in particular wide heads tended to be more intelligent. "A larger head size indicates greater intelligence," the team of psychologists said. They measured pairs of brothers aged between 20 and 35, noting the dimensions of their heads and then putting them through a series of intelligence and cognition tests.

(From *Hawke's Bay Today*, 27/9/00)

### Oddspot

NEW research shows that being a fat-head may not be so bad after all. Britain's Independent newspaper reported that researchers from the University of Western Ontario had found that people with big and in particular wide heads tended to be more intelligent.

(From *Daily News,* 27/9/00)

### Bikinis make women dim — psychologist

**WEARING a bikini makes a woman dimmer, and the more intelligent the woman, the more noticeable the effect, according to British psychologist Rob Bracey. The ability to perform even the most mundane intellectual tasks plummets the more a woman reveals.**

**"A woman wearing a bikini quite simply cannot think straight. If you are wearing skimpy swimwear, then part of your brain is continuously monitoring everyone else around you," said Rob Bracey of Sussex University. "While a woman is wondering what everyone else is thinking, she cannot concentrate on other things. If she goes back to the office she may feel the effect for hours or even days."**

**"It's quite basic psychology," Bracey told the Observer newspaper. DPA**

(From *Daily News*, 28/6/00)

### Herb latest on sex, youth

BANGKOK - A Thai herb producer hopes to make people happy worldwide with herbal root extracts it says help cure impotency and make skin look firmer and younger. Smith Naturals Co says it has taken extracts from two herbs with legendary properties, butea superba and pueraria mirifica, and put them separately in gels, creams and capsules. Extracts from the root and stem of butea superba have been used for hundreds of years to improve male sexual performance while an extract from the root of pueraria imitates estrogen and helps reduce ageing. - Reuters

(From *Marlborough Express*, 28/6/00)

### Tell-tale fingers

LONDON: Transsexual men and women are mainly left-handed and can be identified by their distinctive fingerprints. Richard Green, professor of psychiatry at Imperial College, London, told the Royal College of Psychiatrists that research had shown transsexuals have strongly ridged fingerprints. Other research showed transsexuals tend to have more aunts than uncles on their mother's side.

(From *Evening Standard*, 24/7/00)

**Figure 5.7.** Three newspaper articles from October 23, 2000 reporting a British scientist's claim that Viagra helps women to become pregnant. These articles illustrate how editing can alter the news content of a story by deleting cautionary statements and contextual information.

a)

## Viagra boost for mum

British women are using Viagra as a fertility drug to help them get pregnant.

New Zealand fertility experts are not recommending the anti-impotence drug to couples here but about 10 British women have conceived while using Viagra.

Dr Mohamed Taranissi director of the Assisted Reproduction and Gynaecology Centre in London, said early results were promising.

Among them is marketing consultant Sharon Row, aged 31, who is six months pregnant with twins after doctors suggested that she take the drug, which is more commonly associated with male impotence.

She told Britain's *Sunday Mirror*: "My first reaction was to laugh out loud when the consultant suggested Viagra."

Mrs Row and husband Steve, who live in the Home Counties, had been trying for a baby for four years without success.

She said: "While the thought of me being on Viagra seemed absurd, I would have tried anything that provided the slightest chance of Steve and I becoming parents. After just a fortnight I was told I was pregnant."

Mr Row, 36, said: "At first I was sceptical when it was suggested Sharon try Viagra — it sounded like a bad joke and there was no end of mickey-taking from my friends.

"But now I cannot thank the consultant or the drugmakers enough.

"They have given us a family, something we'd lost all hope of being lucky enough to have."

Dr Taranissi said the drug was being used by those with a particular problem — a thin uterus lining — which he said affected 5 per cent of women in Britain.

His work follows pioneering trials by Dr Geoffrey Sher in Las Vegas.

Dr Sher worked on the principle that the rush of blood which makes Viagra popular with men could be used to increase the thickness of a woman's uterus lining, giving a better chance of implantation of a fertilised egg during IVF treatment.

The medical director of New Zealand company Fertility Associates, Richard Fisher did not recommend using Viagra as a pregnancy aid.

"The problem is the only studies that have been done so far have been small and not part of controlled trials. I don't think we would be recommending it yet, there's just not enough proof."

(From New Zealand Herald, 23/10/00)

b)

## Pregnant and it's due to Viagra

LONDON — About 10 British women have conceived while using Viagra to help them become pregnant.

Among them is marketing consultant Sharon Row, 31, who is six months pregnant with twins after doctors suggested she take the drug, which is more commonly associated with male impotence.

She said: "My first reaction was to laugh out loud when the consultant suggested Viagra."

Mrs Row and her husband Steve, who live in the Home Counties, had been trying for a baby for four years without success.

She said: "While the thought of me being on Viagra seemed absurd I would have tried anything that provided the slightest chance of Steve and I becoming parents. After just a fortnight I was told I was pregnant."

Mr Row, 36, said: "At first I was sceptical when it was suggested Sharon try Viagra — it sounded like a bad joke and there was no end of mickey taking from my friends.

"But now I cannot thank the consultant or the drug makers enough.

"They have given us a family, something we'd lost all hope of being lucky enough to have."

Dr Mohamed Taranissi, director of the Assisted Reproduction and Gynaecology Centre in London, said about 10 of his patients, including Mrs Row, were now pregnant after taking Viagra.

One woman had a positive pregnancy test today, he said.

The drug was being used by those with a particular problem — a thin uterus lining.

Reuters

(From Daily Post, 23/10/00)

c)

## Viagra helps

LONDON: About 10 British women have conceived while using Viagra to help them become pregnant, it emerged tonight.yesterday.Among them is marketing consultant Sharon Row, 31, who is six months pregnant with twins after doctors suggested she take the drug, which is more commonly associated with male impotence.

(From Evening Standard, 23/10/00)

# CHAPTER 6:

# INTERVIEWS WITH NEW ZEALAND JOURNALISTS WHO REPORT SCIENCE

## 6.1. Introduction

The goal of this portion of this thesis was to explore through in-depth interviews with New Zealand journalists who report science what various forces that might cause the patterns observed in the content analysis of New Zealand science news (see Chapter 5).

In particular, I was interested in why journalists frequently fail to independently verify the validity of scientific claims, and why they tend to use a balance strategy when presenting conflicting claims. I was also interested in journalists' perceptions of maverick scientists, given that maverick science was infrequent in the content analysis, yet the survey of journalists (see Chapter 4) indicated that many journalists were not opposed to presenting mavericks in principle.

As discussed in Chapter 3, accuracy (the goal of verification) and balance are two sub-components of the journalistic norm of objectivity (Westerstahl 1983). Thus, another key goal of the interviews was to understand how New Zealand journalists conceptualise objectivity and how this might influence their strategies for verifying claims and reporting contested science.

Boyer (1981) used a factor analysis to show that US wire editors generally agreed about what objectivity means but emphasised different elements. His analysis grouped the journalists into three types according to which aspects of objectivity they stressed. Type I editors valued balance and the accurate reporting of both sides of an issue. They saw objectivity largely as an achievable goal, although they did not think that it excludes interpretation. In contrast, Type II editors perceived objectivity as an "unattainable goal" that journalists strive for by minimising their personal opinions. Type III editors, like Type I, defined objectivity in terms of balance, but in the more relativistic sense of a lack of bias. Many of these journalists also believed that objectivity is largely attainable, but unlike Type I, they also avoided interpretation.

The small sample size in this study (21 journalists) precluded a quantitative factor analysis similar to Boyer's, but it was possible to qualitatively group the respondents according to their definitions of objectivity. By developing similar typologies according to how the journalists defined accuracy and balance, I was able to look more closely at the relationship between these different concepts and to probe how journalists' understanding of objectivity, accuracy and balance influences the way that they verify scientific claims and report controversial science and maverick science.

## 6.2. Methods

I chose qualitative interviewing to investigate these issues in more depth, because the purpose of interviewing is to understand the meanings of respondents' experiences and world views in order to make "cultural inferences" (Spradley 1979, p. 8). In this case, the goal was to infer patterns and themes in the journalistic culture. Grounded theory was used to analyse the data, because it enabled me to explore questions as they emerged from the data, rather than shaping the data according to preconceived assumptions and categories (Charmaz 2002).

Twenty-one unstructured interviews were conducted with journalists from around New Zealand who regularly cover some aspect(s) of science. The journalists represented a range of print, radio and television media. They also had diverse positions, including news reporters with health, agriculture, environment or science rounds, freelance journalists and feature/programme reporters.

All but one of the interviews were conducted in person. Each interview took 1-2 hours. The interviews were open-ended to allow the journalists to discuss the factors most important to them, rather than restricting their discussion to a pre-defined list of potential forces identified in the literature. The interviews focused on the following general topics:

- selecting scientific sources,
- accuracy in reporting scientific claims,
- verifying scientific claims,
- maverick science,
- balance,
- objectivity,
- scientific controversy, and
- the journalist's background in both science and journalism.

All of the interviews were taped, fully transcribed and then analysed using the qualitative computer software package NVivo (Gibbs 2002). The interviews were analysed in the tradition of grounded theory, which emphasises inductive analysis and the building rather than testing of theory (Strauss and Corbin 1998). Portions of the interviews are presented here in quotation marks or as indented quotes.

Unfortunately, too few stories in the content analysis were written by a New Zealand journalist to allow for a quantitative comparison of journalist attributes and their science coverage. Forty-four New Zealand journalists had a by-line in the content analysis sample, but only eight of them produced more than one unique story in the sample. Four of these journalists were interviewed, and the remaining four only produced two articles each and none of them focused on science as a significant part of their job.

Thus, a limitation of this study is that the interviewed journalists did not produce the actual coverage analysed in the content analysis. However, these journalists were chosen because they devoted the most time to science of all mass media journalists in New Zealand. As such, they could provide the best insight into the ways that New Zealand journalists think about science reporting. Although this comparison is not ideal, it was the best design that could be achieved within the limited time-frame of this study. An alternative design would have been to follow the interviewed journalists' coverage over several years. However, because no comprehensive electronic databases of New Zealand media coverage were available at the time, such a study would have had to focus on new coverage rather than analysing past coverage. It would therefore probably require at least 2-3 years to reach an adequate sample size for analysis.

## 6.3. Results

The interviews generated wide-ranging discussions about objectivity, accuracy, verification and balance. The first step I took in analysing this data was to categorise the interview respondents into general groups (following Boyer 1981) according to how they defined the concepts of objectivity, balance and accuracy. These categories were then amalgamated to form three general types: the 'Transmitter', the 'Truth Seeker' and the 'Contextualiser'. This typology is not intended to be rigid, and journalists did not always neatly fit one category. However, the categories generally described the divergent definitions of the concepts well and they enabled me to study whether journalists who defined objectivity in a certain way were more likely to verify claims, to present the weight of evidence for conflicting claims and to report maverick science. I begin with this analysis and then turn to other factors that the interviewed journalists discussed that may influence verification and balance.

### 6.3.1. Objectivity types

*6.3.1.1. Objectivity categories*

I began this qualitative analysis by using Boyer's categories as a starting point to explore the data. I found that two of Boyer's Types (III and II) fit this data well (see objectivity categories A and B respectively), but that his third type (Type I; similar to Type III in their emphasis on balance but not excluding interpretation) did not apply in this case. Instead, a different category (C) emerged that rejected the objectivity concept entirely. Below are brief descriptions of the three objectivity categories that emerged from this data.

*Objectivity category A*: These journalists said that objectivity means balance, or reporting both sides fairly. They said that objectivity is achievable in this sense, and that journalists should present the 'facts' without interpretation or analysis of those facts.

For example, one journalist explained how s/he reported a study investigating the effects of mental illness:

> Really all I was doing was reporting his view, summarising this paper and then getting some quick comment on it from somebody else. So it wasn't an attempt to establish whether or not there was a link [with mental illness]. All I was reporting was his findings.

*Objectivity category B*: This group of journalists said that objectivity means minimizing personal opinions in your reporting as much as possible. These journalists accepted that journalists can interpret and analyse claims, but many were still wary of providing their own evaluation of scientific evidence. They saw objectivity as a goal that journalists must strive for even though it is ultimately unachievable. For example, two journalists said:

> I think you really do need to try and divorce yourself from your opinions and just write the other side of the story…So I'm doing it all the time. I've done things where I think 'jesus christ what am I doing here?'. You know, it's just a different way of looking at things, they have a different way of looking at things. That's my job. Professionalism. So I'm doing it all the time.

> It is something you have to strive for, knowing that you'll never quite get there.

Category B journalists gave four general reasons that they strive for objectivity despite the fact that it is unachievable. First, it ensures that the audience receives credible information that is not just based on the journalist's opinion. Second, objectivity lends journalists credibility and builds the audience's trust in their accuracy and honesty. As one journalist said, journalists "seem more professional" when they use these objectivity strategies. Third, objectivity can help journalists deal with complaints because they can say they have followed established professional practices to write the story in that particular way.

Finally, journalists said that objectivity strategies are important because they may help journalists critically tackle issues. One journalist said that being forced to address different points of view "can catch you and shake up your preconceived ideas." Thus, objectivity encourages journalists to fully investigate their stories and to become aware of the context and debate surrounding each issue they cover. One journalist pointed out that different perspectives might not always be used in the final story, but the journalist should at least know about the different perspectives in case they emerge later:

> [Objectivity] is strived for so at least you as a journalist know as much as you possibly can about the topic, and even if you put somebody's views to the side for now, you still know they're over there and then they won't come and kick you in the butt one day.

*Objectivity category C*: The third group of journalists said that objectivity is a meaningless concept, because all journalists make subjective decisions that influence their reporting. They thought that journalists can avoid overt opinions (although sometimes even this is not desirable) but their opinions will always colour their work. Therefore, they said it is better to talk about accuracy, fairness and balance. For example, several journalists said:

> ...if you're a Maori reporter, a pakeha reporter, a Palestinian – you know, let's face it. Objectivity depends on where you live and who you are.

> I am aware that the journalist's job is selection of the most important facts. There are always more facts than you can fit in a story, or usually...and obviously it's a subjective process where the journalist has to decide what are the most important ones to report.

Only two of the interviewed journalists belonged to objectivity category A, while ten journalists fit category B and nine journalists fit category C. Thus, only two of the journalists in this study believed that objectivity is actually achievable and 43% of the respondents said that objectivity is not a useful concept at all.

#### *6.3.1.2. Accuracy categories*

Next I categorized the journalists into three categories according to their definition of accuracy:

*Accuracy category A*: This group said that accuracy means accurate reproduction. They thought that news sources – not journalists – are responsible for the truth of their claims. Therefore, as this journalist suggests, it is acceptable to report maverick scientists even if their claims are outrageous:

> ...it's not for us to decide what people should or shouldn't read. Readers should

> be able to make up their own minds. And if an outrageous claim is reported, or maverick science, or science that is not generally accepted, we should still publish the opinion of the scientist who is making the particular claim.

*Accuracy category B*: These journalists accepted a responsibility for the validity of their sources' claims. They said that journalists must go beyond accurate reproduction to try to ensure that any claims they present are valid, or supported by sufficient scientific evidence. Maverick claims that are not supported by evidence should not be reported or should be presented in a way that discredits them.

*Accuracy category C*: These journalists said that sometimes they can check the validity of facts within their stories but more often they just present opinions that cannot be verified. Thus, they thought that the journalist's job is to provide context for any claims presented, not to decide whether a claim is right. Mavericks should always be balanced with majority views and placed in a context that enables the audience to interpret the claims.

The three accuracy types were significantly associated with the three objectivity types ($\chi^2$ = 23.82, df = 4, p = 0.0001; Table 6.1). Both of the journalists who fit objectivity category A also fit the accuracy category A. Similarly, seven of the ten journalists who fit the accuracy category B were assigned to objectivity category B. Six of the nine journalists who fit the accuracy category C were also in objectivity category C.

**Table 6.1.** The number of journalists included in each objectivity and accuracy category. The numbers in bold represent the categories that are most closely associated with each other.

| | **Accuracy** | | |
|---|---|---|---|
| | Category A | Category B | Category C |
| **Objectivity** | | | |
| Category A | **2** | 0 | 0 |
| Category B | 0 | **7** | 3 |
| Category C | 0 | 3 | **6** |

*6.3.1.3. Balance categories*

Finally, the journalists were also divided into three categories according to their definition of balance:

*Balance category A*: These journalists said that balance means reporting all relevant sides fairly. They thought that a 'he said, she said' approach is sufficient rather than discussing the evidence for each side.

*Balance category B*: Journalists in this category said that balance is a "double-edged sword", as one journalist called it. They thought that balance is necessary but can create problems in reporting scientific issues such as climate change where minority views are balanced against the majority consensus. Thus, journalists need to provide an evaluation of the weight of evidence for each side and inform their audience of which claim is more likely to be true given the available evidence.

*Balance category C*: These journalists also said that balance is a double-edged sword in some cases, but they stressed the lack of information in the 'he said, she said' approach rather than the lack of interpretation. They said that journalists should provide a context for conflicting claims to help their audience make up their own minds, but they did not think it was their job to decide which claim is more likely to be 'true'.

The balance categories were not significantly associated with the objectivity categories ($\chi^2 = 8.78$, df = 4, p = 0.0668; Table 6.2). The balance categories A and C corresponded well to objectivity categories A and C respectively, but journalists in objectivity category B had more diverse definitions of balance. This reflects the journalists' reluctance to provide their own interpretations of scientific evidence, rather than leaving it up to their audience to decide. Three objectivity category B journalists were the only journalists in balance category B.

**Table 6.2.** The number of journalists assigned to each objectivity and balance type.

| | Balance | | |
|---|---|---|---|
| | Category A | Category B | Category C |
| **Objectivity** | | | |
| Category A | 2 | 0 | 0 |
| Category B | 3 | 3 | 4 |
| Category C | 2 | 0 | 7 |

*6.3.1.4. Objectivity types: Transmitter, Truth Seeker and Contextualiser*

The above analysis suggests that the way that journalists defined objectivity is closely related to the way that they defined accuracy and balance, and that three general types can be identified. First, the *Transmitter* type includes journalists who defined objectivity primarily in terms of balance. They also said that accuracy means accurately reporting what sources say and relinquished responsibility for their sources' claims. Likewise, these journalists said that balance means presenting all sides fairly, regardless of how much evidence the source has to support their claims or how likely the claims are to be true.

Transmitters were thus most likely to see themselves as neutral disseminators of information rather than as active participators in their stories. These journalists said that they do not seek out multiple sources for many science stories because their job is to explain or translate science into a form that the layperson can understand, not to offer a variety of opinions about a scientific claim. For example, one journalist said:

> I see the essence of journalism as informing people about what is going on in the world, and giving people ways that they can use, promote or question that information. I am interested in understanding new ideas, discoveries and technologies, and communicating them to the readers. I may include alternative views if I am aware that they exist, but I am not usually aiming to produce a balanced story; I am aiming to...get the information or claims out there, so that people can then use, promote or question that information or those claims as they see fit.

The second type of journalist in this study, the *Truth Seeker*, defined objectivity as an unachievable yet desirable goal that they strive for by minimizing the effect of their personal opinions on their reporting. These journalists believed that they are responsible for ensuring that their sources' claims are supported by sufficient evidence. It seems these journalists are less relativistic than the third type of journalists (the *Contextualiser*; see below), in that they believed that some claims are objectively more valid than others. Some of these journalists believed that they can and should evaluate the relative truth of claims, but most were hesitant to include their own interpretations or analysis of scientific evidence. The differences of opinion over balance among Truth Seekers illustrates the tension for journalists between minimizing their own opinions and yet striving for 'truthfulness' in their reporting.

The third type of journalist in this study, the *Contextualiser*, saw objectivity as a useless concept, because every journalist makes subjective decisions that influence their reporting. Most of these journalists thought that to be accurate they should provide claims in a context that enables readers to interpret them, but they did not think that journalists can or should provide readers with an assessment of the probable validity of claims. Similarly, in balancing conflicting claims, they did not believe it was the journalist's role to decide who is right.

Clearly, this framework is only a general model and not all journalists fit neatly into these categories. However, this conceptual framework is a useful way to examine how varying notions of objectivity may influence the way that journalists report science. More specifically, it can affect the way that journalists verify claims, report maverick scientists and present conflicting claims. The effects of objectivity type on these practices are discussed below along with the other factors that journalists talked about during the interviews.

### 6.3.2. Factors affecting verification

#### *6.3.2.1. Objectivity type*

The goal of verification is to ensure accuracy, but the Transmitter journalists in this study conceptualised accuracy as 'accurate reproduction' rather than as an 'accurate representation of the truth'. These journalists said that their responsibility is to accurately reproduce what sources tell them, including representing people's claims fairly, not omitting important information or facts and not quoting sources out of context.

> Now in terms of accuracy as far as my responsibility is concerned, is that I accurately represent what people are saying. It's no good me paraphrasing somebody's argument if the person feels that what they say about something is not then being accurately represented...

Transmitters also emphasised the importance of attributing claims to named sources. Attribution enables the audience to know exactly where each bit of information came from, and it also may protect journalists when they report uncertain or preliminary claims. For example, one journalist said that attribution is important "for your own safety" because it reminds readers that "I'm not saying this, this is what I have found out or this is what they tell me." One journalist said that attribution "gets me off the hook" because it makes the source rather than the journalist responsible for the accuracy of the information.

In contrast, the Contextualiser journalists said that they not only have a responsibility to "get the facts right" (i.e. the Transmitter definition of accuracy) but also to present these facts in a context that would help their audience understand the claims. However, these journalists said that verification did not include the need to establish the probable validity of their sources' claims. Several Contextualisers explained that although they try to provide a context for scientific claims, their role is simply to report other people's claims rather than judging their probable validity.

> Being a journalist, in some ways you've got to take people's comments at face value or you don't have a story. Your role is to report people's opinions, what they think about this, what this person said, and it's got to be reported as accurately as you can – whereas as a scientist you've got to actually question whether the things that people are telling you are true, are factual.

Only Truth Seekers indicated that they felt responsible for verifying the probable validity of the truth claims that they report. These journalists said that attribution does not supplant a journalist's responsibility to try to present the 'truth'. However, all of the journalists qualified this by saying that although they have some responsibility for ensuring facts are correct, they do not feel responsible for the validity of "opinions that people honestly believe are true." In other words, as long as the claim is presented as someone's opinion, it may be sufficient to present the claim at face value.

> The journalist has a responsibility to ensure that their source is credible. But their responsibility for the accuracy of the claim varies from just presenting their view to actually verifying the claim. Sometimes you don't need to verify the source is right, you are just saying 'this person says this'. Other times, you need to verify the claim.

In summary, we can say that Transmitters may be less likely to seek independent verification for the claims they report than journalists who fit the other two objectivity types. This is because Transmitters generally see themselves as passive reporters or transmitters of information, rather than taking responsibility for the truthfulness of the claims they present. In this study, only two journalists fit the Transmitter category, although given the small sample size, this is not necessarily a reflection of the percentage of New Zealand journalists overall who might fit this type.

*6.3.2.2. Perceptions of controversy*

A second reason that journalists may not verify scientific claims is that they perceive science as a non-controversial subject that does not require balance or the inclusion of alternative viewpoints. Many of the journalists in this study commented specifically that the scientific claims that they usually report are not controversial and do not require balance. They said that most of the science they cover is about "straightforward discoveries", which do not require verification.

> The reason I write the articles is to explain the science behind a new technology or development, not to offer a variety of opinions on it, but simply to describe the science involved. That's really my main brief, personally.

One journalist said that "very little of what we write about science is contentious," and another said "we don't often seem to have the situation where we've got different scientists overtly disagreeing among themselves." Another journalist suggested that this phenomenon may be unique to New Zealand:

> Also somewhere like NZ, it seems like there are a lot of individuals at the top of the pecking order in their fields and not too many contradictory things or people

in those fields.

Thus, journalists generally seem to distinguish between straightforward research (which is primarily what they report) and issues such as genetic engineering and climate change, which have policy implications or a direct impact on people and so require more verification and balance. Even with issues such as GE and climate change, the journalists said that the controversy mainly occurs amongst non-scientists and interest groups who disagree about the potential implications for society or the associated effects on public policy. The journalists perceived a much greater need to verify these claims because of the potential implications for their audience.

> …there are obvious science stories, we can cover engineering, earthquake engineering till the cows come home or superconductivity or all sorts of things without too much concern for the nature of the science involved. It's just a straight reporting of things the man tells me, 'this is what we're doing here, report x, y, z'.

> I think if it related to a pharmaceutical or health issue, you know that's the classic thing – health breakthrough type thing, then you would make much more effort to check the validity of the so-called breakthrough…to check that with other experts in the field – than you would if it's what I would call a basic science, a laboratory science story about ongoing research or research results.

*6.3.2.3. Trust in mainstream science*

A third and closely related reason that journalists said they might not verify certain scientific claims is their trust in mainstream scientific institutions and 'experts'. In particular, journalists said that they trust the scientific peer review process to check the validity of claims for them. Thus, if they can ascertain that a claim has been peer reviewed, they may be unlikely to independently verify the claim themselves.

> So getting to grips with the story is often quite difficult, and then to spend a lot of time checking up on its validity – if it's theoretical or basic science that's been peer reviewed and published, I'm not sure whether I would really bother. Because people far more competent than me, or just as competent as the people that I can track down, have checked it out.

Similarly, journalists said that the credibility of "mainstream" scientists that work at universities and respected public and private research institutions gives them confidence to report claims without verifying them.

> If someone's done some research at Lincoln University and you go and see them and it all sounds very credible and interesting, I don't know whether you'd go to another source for that.

Publicly-funded institutions may be seen as having a degree of independence because they lack vested interests and commercial imperatives that might influence their results. Journalists said they are often suspicious of stories from private companies that might have a commercial interest in media publicity.

> ...we get in a way given science stories by the companies, and often there's an ulterior motive behind it that might not become clear until later.

#### *6.3.2.4. Lack of scientific contacts*

A fourth potential reason that has been suggested in the literature for the abundance of single-source stories is that journalists do not know who to contact to verify scientific claims (Friedman 1986). One journalist said that they often do not know whom to contact to verify scientific claims, but three others said that it is easy to find scientific sources, particularly since New Zealand is a small country and scientists tend to know one another. Two other journalists said that it is easy to find scientific sources but difficult to get them to "stick their heads up" and comment on other scientists' research.

#### *6.3.2.5. Time constraints*

A final reason that journalists may not consult multiple sources is that they do not have time. Eleven of the 21 reporters interviewed said that time constraints limit their ability to verify claims or to seek out multiple sources. As one journalist put it, "Time is our biggest enemy, it dictates everything that we do." The pressure to publish stories within restrictive deadlines makes it challenging for journalists to reach scientists, who are busy and often do not understand the much shorter time-frames that journalists must work within. Verification may be particularly difficult when journalists are competing with other news organisations for a story:

> I think there's a lot of pressure on the news team to get a story. I think, in a way, as a reporter I have to try to slow things down sometimes.

The journalists also suggested that time may be a greater constraint in New Zealand than in larger countries because of the limited resources spent on science reporting here.

> I think science reporting in New Zealand – because it isn't very highly regarded – journalists aren't given a lot of time to do stuff. So they don't tend to spend a lot of time cross-checking stuff.

The journalists emphasised that time is particularly limiting for news stories (c.f. features) and that short stories often do not justify more than one source. This is significant considering that the content analysis (see Chapter 6) showed that most science stories in the New Zealand media are short news reports rather than features. The journalists also suggested that time is more limiting for television and radio reporting than for print media.

### 6.3.3. Factors affecting the reporting of conflicting claims

#### *6.3.3.1. Objectivity type*

Many Truth Seekers and Contextualisers recognised that balance can be a potentially dangerous strategy (a "double-edged sword" as one journalist called it) for reporting science, because it can be interpreted as forcing journalists to present opposing claims with equal weight even if the claims are not supported by equal amounts of evidence. However, as one journalist said, "Balance doesn't mean equal weight to both sides of an unequal argument. It means putting things into perspective." Several journalists used the example of climate change to illustrate how balance can distort scientific reporting:

> In covering climate change, I've found that putting the IPCC's findings against two or three individuals who are challenging it wasn't actually a balanced presentation of it. It would help to put it into context of what the IPCC is, in terms of the credibility of it and just its volume, that it's been set up to bring scientists together, and do the same for the individuals. So just bringing in all the voices that you have alone doesn't necessarily balance a story.

However, none of the Contextualisers and only three Truth Seekers said that they felt responsible for evaluating the potential validity of claims themselves. One of these Truth Seekers said:

> I think it's a little bit like walking on the ice. You need to test where the ice is thick and will support the weight of a claim or where it is thin or where it is just simply water and won't support anything. So I guess there's a fairness, are a lot of facts or areas being suppressed here to come up with a result? Is there a fair

> display of evidence? Has it been rationally arrived at?

Another Truth Seeker pointed out that the distinguishing feature of science is its reliance on empirical evidence rather than on opinion:

> And I think that's where it differs significantly from say a political story, where you can have people argue both sides of capital punishment... validly, but you can't have people argue...for example... that gravity doesn't work.

However, the remaining 18 journalists said that when they are reporting a scientific controversy, their job is to simply report the divergent views rather than to decide who is most likely to be 'right'. For example, one journalist said: "I didn't see it as my job to say one of these is more right than the other, but to fairly present their diverging views in the context of each other." Similarly, four Contextualisers pointed out that they cannot empirically prove whether a claim is true or false (or usually even review the empirical data produced by the scientists), so they are reliant on scientist's opinions of the claims.

> When you are talking to people who have done the experiments, you can't go and redo their experiments, or even look at their original data. Therefore you have to believe what they are saying. Well, you have to accept what they're saying. So if other people say differently, then you have to put up both sides and if a third person says something entirely different then you have to present all of it.

On the other hand, many Contextualisers said that journalists do have a responsibility to place claims in context, so that their audience can interpret the evidence for themselves.

> Balance to me is part of providing a fair report...And as part of the fairness and the accuracy, you need to make sure that things are, as far as possible, in a sufficient context to not be distorted. I could tell you that the numbers of New Zealand men who were described as obese were rising rapidly and as a statement by itself, that would be accurate. But without the context of knowing for instance that the proportion of the female population which was technically obese was rising faster, you wouldn't have a fair picture.

*6.3.3.2. Lack of scientific knowledge and experience reporting science*

Only three journalists said that a lack of scientific knowledge limits their ability to evaluate scientific claims. Interestingly, these journalists said that having experience in reporting science is at least as important as having scientific training for journalists to evaluate competing scientific claims. One journalist said that experience is important because journalists become familiar with hoaxes and promotional claims.

> You know about yesterday's miracle cures, or the things that were promoted five years ago, it's just that the reporter who is covering it now was still in high school. So its that historical, institutional memory which comes in not just research but also with the political ramifications which take place in society.

It may also help journalists understand how science operates:

> You don't have specialist science reporters [in New Zealand], so they're not dealing with this on a day-to-day basis. And so they don't understand the importance of publishing for scientists and their careers, and the importance of accuracy, truth, peer review, all that sort of stuff.

*6.3.3.3. Conflict provides news value*

Four journalists said that they balance competing scientific claims because conflict is an important news value. As one journalist put it, "Newsworthiness is something that's controversial, where there will be debate, or where there will be sharply divided opinion." These journalists said that "conflict" and "disagreement" create interest in a scientific topic that might otherwise seem dry and boring. None of the journalists said that they actively seek out scientific controversy, but they did say that conflict was likely to get covered (and often emphasised) when it did emerge.

*6.3.3.4. Time constraints and the lack of specialised science rounds*

Time seems to be a major constraint on journalists' ability to evaluate competing scientific claims. Many reporters complained that they have no time to "really dig into issues" or to understand the broader context of the scientific issues they report. As one journalist said:

> Especially if you're working to an hourly deadline, a lot of these things are just impossible. You know you go for balance because you have to but you don't seek nuances. You just don't have time.

In particular, seven journalists said that the lack of specialised science rounds in New Zealand makes it extremely difficult for journalists to produce analytical or in-depth science stories. It limits the time that journalists can spend on each story, because they are usually responsible for a number of other rounds as well. Moreover, even the few news organisations that have science rounds rotate them frequently to keep journalists from getting too close to their sources. Thus, as one journalist said, "One moment they're a science reporter and then three months later they're a rugby reporter."

### *6.3.3.5. Formal regulations require balance*

A final reason that journalists said they use the balancing strategy is that formal regulations such as the New Zealand Broadcasting Act stipulate that broadcast coverage must be balanced and fair toward all sides.

> The balance issue is very important because if it's not balanced, certainly within that story or within the currency of that issue, you may be open to a formal complaint issued to the broadcaster or the Broadcasting Standards Authority. And then if it's a serious case of poor journalism then the broadcaster can be fined or told he can't advertise for a certain time or he can be told he has to make a major apology. It can be a serious matter.

Broadcasters who fall short of these standards can be fined or otherwise punished. Print journalists are mindful of defamation suits and of complaints of "unfair" and "biased" reporting being taken to the Press Council.

## 6.3.4. Factors affecting the reporting of maverick science

### *6.3.4.1. Objectivity type*

Of all 21 journalists, only two Truth Seekers said that they would not report maverick science claims with which the majority of scientists disagreed.

> I feel like if they're not mainstream science in some way, then I'm not going to report it, because there are so many flakes and crackpots and pseudo-scientists out there that I'm just not interested.

The remaining 19 journalists all said that they would report maverick claims, but they varied in how they would present such claims. Transmitters said that they would simply report the maverick claims and let readers decide for themselves. This is in line with the Transmitter perception that the journalist has no responsibility for the truthfulness of sources' claims. These journalists said that as long as the claim was attributed to the scientist, it is the scientist's responsibility for the truth of claim.

> If they were saying that it sounded like the claim was bogus then I'd probably still write the story. I mean they're staking their reputation, aren't they.

In contrast, all of the Truth Seekers who said they would report mavericks said that they would present the claims in a way that discredited them. Some of these journalists suggested that people may be aware of the maverick claim anyway and so reporting the claim can be a good way to discredit it or to explain it further. They might do this by giving the maverick only a brief mention, or by explaining that the claim is not supported by the evidence at hand and that most scientists do not support it.

> So just simply ignoring something that sounds ludicrous, charlatan and impossible because we see it as to be not true may be all right in a perfect world but people still believe these things. They hear about it, they read about it. I think it's the media's job to put these people under scrutiny.
>
> For example, someone rings up and says look I think I've seen a UFO. Well you could say look UFO's don't exist, that's bloody ridiculous and hang up. But in actual fact in that particular case, by just inquiring into it a little bit carefully and doing a little bit of further analysis, I ended up with quite a good story which treated the person respectfully but also kind of injected a little bit of science into it as well.

Most Contextualisers had a similar view, although they were not concerned with discrediting the mavericks altogether, but rather thought they should place the claims in a context that would enable the reader to make up their own minds about the claims. Like Transmitters, Contextualisers were reluctant to judge maverick claims, particularly since the claims might "turn out to be right someday".

> I tend to put other points of view in that case because really in a way, because even though there is a heavy weighting for climate change being influenced by emissions of greenhouse gases, the jury is still out in a little bit, and you never want to cut off that 1% opinion because even though you want to explain to the public that its only 1% of the people—you don't want to cut it off in case they're right. And then you'll look like a dickhead if you've really stuck with only reporting on this other side, because we still really don't know.

Other Contextualisers pointed out that maverick claims can have important implications for people's lives. If the mavericks have political influence (e.g. climate change scientists) or if they are in positions of authority, journalists said that their claims are newsworthy regardless of how well-substantiated the claims are.

> ...sometimes you'll get a situation where someone is say, the mayor of somewhere or other or some person in public office or some person known to be of some significance...If that person makes some outlandish claim, then to some extent there may be some merit in reporting that under some circumstances.

*6.3.4.2. Reliance on mainstream scientists*

A second factor that may influence (in this case discourage) the coverage of maverick scientists is the tendency for journalists to use mainstream scientific institutions as 'routine sources' of information. Journalists said that they use mainstream organisations because they are seen as credible, independent sources of information. In addition, scientific organisations are obvious and easy places to find relevant scientific sources.

> Not only is it important that they have good credentials but also they're the obvious place to find somebody. If there is a well-known person that isn't associated with any well-known institution then you might still go to that person. Like Jeanette Fitzsimons for example. But in the absence of knowing a particular person, you go to the institution, the obvious institution.

Journalists also said that it is easy to find out about a New Zealand scientist's reputation because this is a small country where scientists are familiar with all other scientists in their field. Once a journalist has worked on science stories for a while, they become familiar with the experts in the field and how respected they are by other scientists. In particular, maverick scientists may lose credibility by becoming known as "single-issue campaigners".

> ...he's lost credibility by becoming a single-issue campaigner and the tactics that he uses has made him lose credibility in my view. I mean he's personally criticised a number of researchers at the Ministry of Health. He picks at people's personalities with whom he disagrees.

*6.3.4.3. Accessibility and news value*

A third factor that may influence reporting of mavericks – and in some cases counteract journalists' reliance on mainstream organisations – is the accessibility of the scientist and the news value of the claim. Although mainstream organisations are generally easily accessible, there may be cases when a maverick is the only person available within the limited time-frame. Similarly, maverick sources who are "louder" than the mainstream organisations are likely to receive coverage. In addition, often maverick scientists or lobby groups may come out with more provocative (and therefore more newsworthy) statements than mainstream organisations.

> ...large institutions are quite often not the best communicator. Smaller groups, be it a lobby group or some scientists with a tangent point of view, capture the media more easily. And it's got to do a lot with the type of assertions they make, their willingness to communicate it with the media. So for example, they kind of want a headline, they want to contradict some institution. They're willing to help you get their view across. And the media doesn't really make a lot of judgement. It'll accept it as a provocative story and run it. So really it comes a lot down to a provocative statement that captures the media interest.

In addition, maverick sources that are articulate or provide good sound bites may be chosen over scientists who use jargon and complicated technical explanations. Likewise, if a maverick comes out with a definitive statement on an issue, they may be preferred to scientists that hedge every statement with conditions of uncertainty. Maverick scientists who are aware of these constraints and media norms may use them to their advantage.

> But reporters want certainty...because it makes for good headlines. It's much better to say 'global warming is happening' than 'I think global warming might happen if this happens'. And so the whole hedging process and the error bars and things that are a major part of science get alighted away and you end up hearing from people who are not necessarily the best scientists but who have a cause to push sometimes.

## 6.4. Discussion

### 6.4.1. Objectivity type and perceptions of accuracy and balance

A qualitative categorisation was conducted on the interview data in this study to describe how journalists define objectivity, accuracy and balance. Three categories emerged for each concept and the categories were for the most part (especially for accuracy and objectivity) closely related. This suggests that these three concepts are inter-related, as Westerstahl (1983) described in his model of objectivity (see Chapter 3). The only types that did not correspond well were objectivity category B and balance category B. Only three of the objectivity category B journalists were in balance category B, which shows the journalists' reluctance to provide their own analysis and interpretation of scientific evidence.

Amalgamating the objectivity, accuracy and balance categories then, the three objectivity types that emerged from these interviews are as follows:

*The Transmitter*: Transmitters were generally more concerned with accurately reproducing the relevant points of view, rather than the validity of those different views. They viewed objectivity as an achievable goal that journalists attain by fairly balancing and accurately transmitting both sides of an issue. News sources – not journalists – are responsible for the truth of their claims. Therefore, they said it is acceptable to report maverick scientists no matter how ridiculous their claims are, and conflicting claims should be presented equally even if they are supported by unequal evidence. Only two journalists (10% of those interviewed) in this study belonged to the Transmitter category.

*The Truth Seeker*: Truth Seekers were primarily concerned with 'truthfulness' in their reporting. They defined objectivity as minimizing personal opinions in their reporting as much as possible, and they saw objectivity as a goal that journalists must strive for even though it is ultimately unachievable. Truth Seekers thought that they have a responsibility for the validity of their sources' claims, and so they must try to ensure that any claims they present are supported by sufficient scientific evidence. Maverick claims that are not supported by evidence should not be reported or should be presented in a way that discredits them. These journalists had various ways of handling controversy, with some accepting a 'he said, she said approach', some emphasising the need for context and some providing interpretations of which claim is most likely to be true. Ten of the journalists in this study (48%) were grouped as Truth Seekers.

*The Contextualiser*: Contextualisers thought that objectivity is a meaningless concept, because all journalists make subjective decisions that influence their reporting. They said that it is better to talk about accuracy, fairness and balance. Sometimes they said they can check the validity of facts within their sources' claims but more often they just present opinions whose validity cannot be verified. Thus, Contextualisers thought that the journalist's job is to provide context for any claims presented, not to decide whether a claim is valid, so that the audience can make up their own minds about which claim to believe. Similarly, they said that mavericks should always be balanced with majority views and placed in a context that enables the audience to interpret the claims. Nine journalists in this study (43%) were grouped in the Contextualiser category.

According to this conceptual framework, the key distinction between the three objectivity types is where the journalist believes the responsibility lies for evaluating the validity of scientific claims. Transmitters said that their sources are responsible for their claims, and so they just reproduce the various relevant claims, even if they are maverick views that are not supported by scientific evidence. In contrast, Truth Seekers assumed responsibility for the claims they report, and thus they would probably be more likely than other journalists to try to independently verify scientific claims. They would also probably be the most likely to omit or discredit maverick claims. Finally, Contextualisers thought that the audience should evaluate conflicting claims themselves, and thus they said they try to present the various views in a context that will enable readers or viewers to make up their own minds.

Table 6.3 shows the relationship between this typology and three other studies that have looked at: 1) the strategies journalists use for reporting scientific claims (Dunwoody 1999); 2) journalists' role conceptions (Johnstone et al. 1972); and 3) the way that different journalists define objectivity (Boyer 1981). First, Dunwoody (1999) described three strategies that journalists may use to report controversial science: 1) an "objectivity" strategy, which emphasises accurate reproduction rather than an accurate representation of scientific truths; 2) a "balancing" strategy that reports both sides in a fair and balanced manner; and 3) a "weight of evidence" strategy that gives the audience an evaluation of which truth-claim is supported by the most scientific evidence.

**Table 6.3.** A comparison of the three objectivity types developed in this study against three other studies that looked at the strategies journalists use for reporting scientific claims (Dunwoody 1999), journalists' role conceptions (Johnstone et al. 1972) and the way that journalists define objectivity (Boyer 1981).

| | **Transmitter** | **Truth Seeker** | **Contextualiser** |
|---|---|---|---|
| Objectivity types defined in this study | Objectivity means factual accuracy (accurate reproduction) and balance. It is largely achievable. Sources are responsible for the truth of their claims. | Objectivity means removing personal opinions and it is an unattainable goal. Journalists are responsible for ensuring the validity of their sources' claims as far as possible. | Objectivity is a meaningless concept and it is better to talk about accuracy, fairness and balance. Journalists should present claims in a context that enables their audience to decide which are valid. |
| Strategies for controversial science (Dunwoody 1999) | Most likely to use the "objectivity" strategy. If opposing claims are already presented, might use "balancing" strategy. | Most likely type to use "weight of evidence" strategy, but few journalists will evaluate claims, so probably most use "balancing" instead. | More likely than Transmitters to seek out opposing views and likely to use "balancing" over "objectivity" strategy. |
| Role conceptions (Johnstone et al 1972) | See themselves as "neutral disseminators". | See themselves as "participants" with an interpretive function. | See their role as a blend of dissemination and interpretation. |
| Correspondence to Boyer's (1981) objectivity types | Similar to Type III (objectivity in a literal sense of presenting the facts without interpretation). | Similar to Type II (objectivity is an unattainable goal; detachment is paramount and interpretation is acceptable). | Not similar to Boyer's types. |

The objectivity types developed in this study show that the way that journalists think about the concepts of objectivity, accuracy and balance probably influence which of these strategies journalists are most likely to choose. Transmitters would probably be most likely to choose the objectivity strategy (or the balancing strategy if they were presented with two opposing claims). Contextualisers would probably be more likely to seek out a different opinion and use a balancing strategy most often. Similarly, it might seem that Truth Seekers would be most likely to use the weight of evidence strategy. However, all but three of the Truth Seekers (as well as all Transmitters and all Contextualisers) preferred not to evaluate the evidence for competing scientific claims themselves. Their reluctance reflects the pressure that journalists face to keep their personal opinions out of their stories and to appear fair to all sides, which may partly explain why journalists are so wary of adopting a 'weight of evidence' approach (Dunwoody 1999).

Second, we can also compare the objectivity types in this study to the role conceptions that Johnstone et al (1972) developed for American journalists. Johnstone et al (1972) suggested that journalists can be categorised according to two general role conceptions: 1) "neutrals", who emphasise their role in disseminating information as quickly as possible and to the widest possible audience; and 2) "participants", who stress their role in investigating claims and analysing problems. Weaver and Wilhoit (1991) also studied these role conceptions and found that these roles are not mutually exclusive and that many journalists see their role as a blend of both dissemination and interpretation. In this study, Transmitters would probably be most likely to think of themselves as 'neutral disseminators', while Truth Seekers would be more likely to stress the 'participant' role. Contextualisers would be more likely to blend these two roles, seeing themselves both as disseminators but also as interpreters to the extent that they need to provide audiences with enough information to make informed decisions.

Third, comparing the typology in this study to Boyer's (1981) objectivity factor analysis described at the beginning of this chapter, two of the categories seem to correspond well. Transmitters were similar in their beliefs to Boyer's Type III editors, who defined objectivity in a literal way, as the presentation of facts in an unbiased way. They believed that objectivity is attainable, and they also stressed balance but did not believe objectivity encompassed interpretation or analysis. In contrast, Truth Seekers in this study corresponded most closely to Boyer's Type II editors, who saw objectivity as an unattainable goal and stressed the need for detachment and the distinction between personal opinions and facts. These editors were more open to interpretation and analysis. The third group in this study, the Contextualisers, was different from any of Boyer's types, because they rejected the concept of objectivity altogether. These journalists said that objectivity was not a useful concept and preferred to talk instead about fairness, accuracy and balance.

These results suggest that the journalists in this study differ considerably from Boyer's editors in their definitions of objectivity. Most importantly, in this study the two Transmitters were the only journalists who believed that objectivity was achievable, whereas in Boyer's study, most American wire editors (both Type I and Type III) believed that objectivity was largely attainable. However, the results from this study cannot be generalised to suggest that overall American and New Zealand journalists think differently about objectivity, because the limited sample size in this study means that this group may differ from journalists in New Zealand as a whole. Moreover, Boyer's study was conducted over 20 years before this one, and he studied editors, not news reporters.

However, another study by Donsbach and Klett (1993) suggests that the New Zealand journalists in this study seem to define objectivity more similarly to British and Italian journalists than to American or German journalists. In their study of reporters and editors who report on politics, government and current affairs in different countries, Donsbach and Klett (1993) found that – just like in New Zealand – journalists in all countries identified a number of different elements related to the concept of objectivity (e.g. fairness and balance, the removal of personal opinions and the accurate representation of the 'truth'), but journalists in different countries tended to emphasise different elements. American journalists tended to emphasise fairness and balance, while German journalists emphasised the importance of assessing validity. British journalists were intermediate, with a more even split between the fair representation definition and the validity definition. Italian journalists were also split between these two definitions and a third definition of detachment (called "no subjectivity" by Donsbach and Klett 1993).

The British and Italian results are similar to the results from this study, where 52% of the interviewed New Zealand journalists emphasised fairness and balance (i.e. Transmitters and Contextualisers), while 48% (i.e. the Truth Seekers) also emphasised validity assessments and the removal of personal opinions. Also similar to the results in this study, Donsbach and Klett (1993) found that very few journalists (1-3%) in all four countries included the evaluation or assessment of competing views within their definition of objectivity. This suggests that journalists in other countries agree with the New Zealand journalists in this study that evaluation is not in keeping with the norm of journalistic objectivity.

### 6.4.2. Other factors affecting verification

Apart from the above effects of the objectivity norm, several other factors appear to influence whether or not these journalists verify scientific claims. First, many journalists in this study differentiated between "straightforward" research, which does not require verification, and contentious issues such as GE and climate change, which need to be checked out further. This suggests that in general, New Zealand journalists view science as a consensual process and perceive that scientists rarely disagree about research findings. Such an approach may encourage the reporting of science as a series of discoveries, rather than reporting longer-term issues or problems in science (Nelkin 1995). It may also mean that journalists are unlikely to seek out controversy, even though conflict may be an important news value (see 6.4.3 below).

Second, a related factor that may influence verification practices is the fact that journalists rely heavily on mainstream scientific sources. Many of the journalists said that they do not verify claims that have been peer reviewed or that are made by credible scientists at mainstream scientific institutions. Wilkie (1996) also points out that journalists are highly dependent on peer reviewed journals because it is assumed that these claims have already gone through an internal verification process. Similarly, Entwistle (1995, p. 922) interviewed American journalists and found that peer review gives research an "independent stamp of approval", and that journalists said they do not need to verify information in peer reviewed journals.

Third, journalists said that time constraints limit their ability to verify scientific claims. Deadlines and the push to publish news quickly will always place time constraints on journalists, and studies show that the less time reporters have, the fewer sources they use (Dunwoody 1980). Scientists can be difficult to reach (and often wary of speaking to the media when they are contacted), which can make it difficult for journalists to verify scientific claims within their deadlines (Friedman et al. 1986). Time appears to be particularly limiting for New Zealand journalists who report science, though, because of the very limited resources available for specialised science reporting in this country. All but four of the interviewed journalists discussed the limitations that time places on their science coverage, suggesting that this organisational force affects most journalists who report science in New Zealand. New Zealand's small population and highly competitive media environment mean that there are not enough resources for specialisation in most fields.

Finally, Friedman (1986) suggested that reporters do not know how to find sources for science-related issues, but only one journalist in this study said that they had trouble finding scientific sources to verify claims. In fact, three other journalists said that finding sources in a small country like New Zealand was easy.

### 6.4.3. Other factors affecting the reporting of controversial science

Several factors besides objectivity type also influence the way that journalists report controversial science. First, time constraints may force journalists to choose the balancing strategy over the weight of evidence strategy, because assessing the validity of competing truth-claims can be difficult and time-consuming. Most New Zealand journalists who report science do not have time to dig into the evidence and interpret scientific claims in the context of previous research. Thus, an increase in specialised science reporting might encourage more journalists to use a weight of evidence approach. Einsiedel and Coughlan (1993) found that Canadian full-time environmental writers were more likely to produce more analytical stories, to include background information and to recognise uncertainty.

Second, the way that journalists present scientific controversy also may depend on their experience reporting science. Three journalists in this study said that a lack of experience reporting science made it difficult for them to judge scientific claims. Again, this may be partly a result of the lack of specialised science reporting in New Zealand, since specialty reporting not only gives journalists more time, it also enables journalists to develop contacts and experience reporting science. Experience may help journalists recognise hoaxes and pseudoscience, and it may enable them to interpret new claims in the context of previous research.

Third, some authors have suggested that journalists use the balancing strategy because they do not have enough scientific knowledge to determine for themselves which of the claims is more likely to be true (Lambeth 1992; Nelkin 1995; Ericson 1998; Dunwoody 1999). Three journalists in this study suggested that a lack of scientific knowledge affected their ability to evaluate scientific claims. On the other hand, some journalists said that scientific training can be a disadvantage, because trained journalists are not as effective at translating technical language for a non-scientific audience.

A fourth reason that journalists may use the balancing strategy for scientific controversy is that conflict has a high news value (Cole 1975; Efron 1985; Burnham 1987; Miller 1992; Wilkins 1993; Dearing 1995; Wilson 2000). Although many of the journalists said that most science they cover is not controversial and few of the news items in the content analysis contained any controversy, journalists may tend to emphasise any conflict that does arise. Four of the interviewed journalists indicated that this is an important routine force that influences the way they report scientific claims.

Finally, journalists also said that the government regulations on balance set out by the Broadcasting Standards Authority encourage balance rather than a weight of evidence approach. Although these restrictions only apply to broadcast news, print journalists were also wary of being accused of bias, or even faced with a defamation case. Tuchman (1972) suggests that objectivity routines such as balance are one way that journalists attempt to deflect these potential sources of criticism.

### 6.4.4. Other factors affecting the reporting of maverick science

According to the content analysis of New Zealand mass media science coverage (see Chapter 5), the New Zealand media give very little coverage to maverick or fringe scientists. However, in both the survey and the interviews, most journalists said that they were not opposed to reporting mavericks in principle, although some suggested that journalists should always place them in a context that makes it clear that the mavericks hold minority views. What factors can account for the fact then, that although journalists are not opposed to reporting mavericks, few end up in print?

In addition to objectivity type, these interviews suggest that a major reason is that journalists in New Zealand generally use a conservative process to find scientific sources that favours mainstream organisations compared to fringe scientists. Overseas studies have also found that mainstream scientists are more likely to be cited than other scientists outside of the 'establishment' (Shepherd 1979; Stocking 1985; Hansen 1994). For example, Pfund and Hofstadter (1981) found that in media coverage of early attempts at genetic modification in the 1970s, mainstream scientists had a greater role in setting the media agenda than community leaders or scientific 'outliers'. Sandman and Paden (1979) also found that different news organisations relied on the same small group of scientists in covering Three Mile Island.

The journalists interviewed explained that they generally consider mainstream organisations to be the most credible scientific sources, as well as an easy and obvious point of contact for scientific information. Word-of-mouth and previous contact with sources are important ways of locating 'experts', so that a few highly visible scientists known to be reliable media contacts may often get wide coverage, sometimes outside of their specific expertise. Nonetheless, maverick science may be reported if the maverick is the most (or the only) accessible scientist, or if the claim is highly newsworthy.

## 6.5. Conclusions

The interview data presented in this chapter suggest that several different factors contribute to the patterns observed in the content analysis. First, the abundance of single-source stories may be due to the following factors:

- Some journalists view accuracy as "accurate reproduction" rather than an "accurate representation of the truth". These journalists ("Transmitters") do not see the need to determine the validity of sources' claims. They see their role as reporting science, not offering a variety of opinions about scientific claims.

- Some journalists view science as uncontroversial most of the time, and thus they do not see the need to seek alternative views for claims unless they have obvious implications for the public (e.g. climate change or GE food).
- Journalists generally trust mainstream scientific sources and the peer review process and do not feel the need to verify these claims.
- Journalists have limited time to consult multiple sources.

Likewise, journalists tend to use the balancing strategy to report conflicting claims for the following reasons:

- Interpretation can conflict with journalists' notions of objectivity and balance. Most journalists are wary of letting their personal opinions influence their reporting, and they do not want to appear unfair to one side.
- Journalists have limited time to evaluate competing claims.
- Conflict is an important news value.
- Government BSA regulations stipulate that broadcast journalists must balance coverage. The print media are under similar pressure from the potential for defamation suits.

# CHAPTER 7:

# AUDIENCE RESPONSES TO DIFFERENT STRATEGIES FOR REPORTING SCIENCE

## 7.1. Introduction

### 7.1.1. Audience responses to scientific media messages

Research on media content has tended to focus more on the effects of news on audiences rather than on the forces that shape the news items that journalists create (Shoemaker and Reese 1996). In terms of science communication, however, we still know little about the specific ways that audiences interpret and respond to media messages. As Rogers (1999, p. 179) says, "We know a lot about the audience interest in science, and we know a lot about how science is presented in the mass media. However, we understand a lot less about how audiences make sense of information about complex scientific issues."

Survey after survey in countries around the world show that people are generally interested in science. People use science coverage in the media to gain a general awareness of important issues, but the media also provide basic, functional information that people use to guide their day-to-day decisions (Rogers 1999). A recent study in New Zealand showed that 73% of respondents enjoyed finding out about new ideas in science, and 66% acknowledged the importance of knowing about science in their daily lives (Hipkins et al. 2002). However, 56% agreed that there is so much conflicting information about science that it is hard to know what to believe.

Rogers (1999) explored how people make sense of complex scientific issues through a series of focus groups, where participants read or listened to news stories about global warming and AIDS. The two characteristics that caused particular difficulty for participants were lack of information and lack of context. Participants wanted more basic information that would help them understand the content, and they wanted to know where this new information fitted into the bigger picture.

Of particular relevance to this study, participants also had trouble interpreting balanced arguments and a scientific consensus. Rogers gave the groups a global warming story that said a United Nations panel had reached a consensus that human activity had a "discernable influence" on global warming. Many participants did not believe this consensus, because they were aware of disagreement over the climate change issue from previous media coverage. This suggests that the meaning that journalists imply when they write balanced stories – that the truth is somewhere in the story – may get interpreted quite differently by the audience, who may perceive that no one knows where the truth lies.

Corbett et al. (2002) similarly found that controversy could influence audience perceptions of the scientific uncertainty of global warming. In this study, the introduction of controversy resulted in less uncertainty about global warming among readers. However, this was probably because of the nature of the controversy chosen. The story they chose focused on the thinning of Antarctic ice sheets, which challenged the scientific consensus that global warming is occurring. The controversy that was added – scientists suggesting that ice sheets were getting thicker, not thinner – was consistent with the scientific consensus that global warming is occurring and thus made readers more certain about this consensus. Corbett et al (2002) suggest that if the added controversy had instead called the consensus into question, it may have led to higher uncertainty amongst readers.

Furthermore, even if one media story taken on its own may suggest that scientists have reached a firm conclusion, this conclusion may not be believable if it is read alongside a number of other articles which state contradictory findings or point out limitations in the research. Dunwoody (1999, p. 68) points out that increasing access to information through the internet and other outlets enables people to "assemble meaning on a grander scale by cobbling together stories about the same topic from a variety of places."

### 7.1.2. Journalistic strategies for presenting controversial science

These studies raise the question as to how different journalistic strategies for presenting controversial scientific claims might influence audience perceptions of those claims. Dunwoody (1999) describes three strategies that journalists may use to report controversial science: the "objectivity" strategy, the "balancing" strategy and the "weight of evidence" strategy.

First, the objectivity strategy is used by journalists who cannot judge the truth of a claim, so they ensure that the claim is accurately represented rather than verifying its truth. The emphasis of this strategy is on accurate reproduction of information rather than on an accurate representation of scientific truths. Chapter 6 suggested that this strategy tends to be used by journalists who see themselves as neutral disseminators of information (i.e. Transmitters) and who think that news sources (rather than journalists) are responsible for the validity of their claims.

The second strategy, balance, also enables journalists to avoid judging scientific claims. The journalist simply reports two or more opposing opinions in a fair and balanced manner and leaves it up to the audience to determine which side is right. The goal of this strategy is to present all of the possible options and to leave evaluations to the audience. In Chapter 6, I showed that almost all of the journalists in this study used this strategy to some degree when presented with conflicting scientific claims.

The third strategy, the weight of evidence approach, is the most difficult for journalists because it requires that they dig into the scientific evidence and give the audience an overall evaluation of where the scientific evidence lies. The emphasis in this approach is on helping readers interpret the entire body of scientific evidence for a claim, rather than "leaving them to sift through the duelling representations of uncertainty themselves" (Dunwoody 1999, p. 73). Chapter 6 showed that this strategy was uncommon amongst journalists that were in this study, although Truth Seekers were the most likely to use it.

The purpose of this study was to use focus groups to explore the ways that audiences might respond to these three different strategies for presenting controversial science. I was interested in how each strategy would influence audience perceptions of uncertainty, and what factors might hinder their understanding of the claims, or alternatively facilitate their ability to evaluate controversial claims. This study was small and focused only on a distinct subset of the New Zealand public (university students) because of the costs associated with a larger scale study. Thus, the results were only intended to be a preliminary exploration into audience responses that could be studied further with a wider sample of the population.

## 7.2. Methods

### 7.2.1. Focus groups as a research method

Powell and Single (1996, p. 499) define a focus group as "a group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research." In contrast to surveys, focus groups can describe how audiences interpret media messages. The key characteristic of focus groups is the insight and data produced by interaction and conversation between participants (Hansen et al. 1998). This is one benefit over interviews, which do not allow for group dynamics to be observed. Interaction is crucial because it can highlight a multiplicity of views, values and beliefs about an issue, as well as the language people use to discuss the issue (Kitzinger 1994).

Focus groups are especially suited to exploratory research into what issues and topics concern people and can help generate and explore hypotheses (Kreuger 1988). However, they are limited in their ability to generalize findings to a population, because only a small number of people participate and they are unlikely to be a representative sample. This study had only a small number of groups and included a homogeneous sub-population of University students, so cannot be generalized to the New Zealand public as a whole.

### 7.2.2. Methods for this study

Four 1.5-hour focus groups were conducted on 7-9 May 2001. University of Canterbury undergraduate student volunteers were chosen on a first-come, first-served basis. Students were assigned to groups randomly, with two groups for arts students and two groups for science students. A total of 25 students participated (n = 7, 6, 6, and 5). Students received a $20 food voucher for their participation.

Each focus group read and discussed two sets of three articles (see Appendix 3). One set of articles focused on the environmental risks of genetically modified (GM) crops, and the other set discussed the link between human cancer and power pylons. Each group of students read and discussed both sets of articles, but the order was varied so that two groups (one arts and one science) read and discussed the GM articles first and the other two groups read the power pylon articles first.

The articles were adapted from stories that appeared in newspapers or popular magazines, so that each article was approximately the same length (3/4 page). Each of the three articles in each set was written using one of three strategies for handling scientific uncertainty (sensu Dunwoody 1999): 1) an "objectivity" approach, where only one perspective on the issue was presented as accurately as possible; 2) a "balancing" approach, where two opposing perspectives were presented and were given equal weight; and 3) a "weight of evidence" approach, where two opposing perspectives were accompanied by an assessment of where the weight of evidence lies. The objectivity approach was labelled 'A', the balancing approach 'B' and the weight of evidence approach 'C', so that students could refer to the articles during the discussion.

Each student in the group was given a copy of the three articles and asked to read them in the order received. The articles were arranged randomly in a different sequence for each student to control for order effects. The students were asked to write down their initial impressions of which article they liked the most and which they liked the least prior to discussion. After approximately 10-15 minutes, the group discussed the articles, with a focus on the pros and cons of each approach. The discussion was relatively unstructured so that each group was allowed to identify which factors they thought were most important in creating an effective science article.

## 7.3. Results

### 7.3.1. Reader preferences

The majority of students who participated in the focus groups, prior to any group discussion, thought that among the three articles about power pylons, the weight of evidence article was the best article and that the objectivity article was the worst article (Table 7.1). For the GM articles, the weight of evidence article was also ranked best and the objectivity article the worst, but by a smaller margin than for the pylon articles. All three GM articles (objectivity, balancing and weight of evidence) were voted best and worst by at least 5 of the 25 student participants.

While this ranking should not be taken as an indication of the percentage of even the student population who might prefer a certain approach, this initial ranking provided a starting point for students to begin discussing why they liked certain articles but not others. The group discussion that followed explored differences between the three approaches as well as differences between the GM and pylon articles.

**Table 7.1.** The number of students that rated each type of article the best or worst prior to discussion in the focus groups. To account for the one student who voted for two articles as the 'worst' in both the pylon and GM cases, 0.5 was added to each of the two categories.

| | Pylon | | GM | |
|---|---|---|---|---|
| **Article** | **Best** | **Worst** | **Best** | **Worst** |
| Objectivity | 3 | 19 | 7 | 8.5 |
| Balancing | 4 | 3.5 | 5 | 7 |
| Weight of evidence | 18 | 2.5 | 11 | 7.5 |
| No response | 2 | 2 | 0 | 0 |

### 7.3.2. Clarity

One of the most important factors for many of the students in the focus groups was how clear and easy it was to understand each article. Although it seems like an obvious point, it is important because if the students could not understand the beginning of the article, they were unlikely to pursue the article further. On the other hand, if the article was easy to understand and clear, it often did not matter to the reader how informative the article was.

One approach was not inherently more clear to readers than the others. Instead, how easy the article was to understand seemed to depend on the detail of the article, especially the use of technical words, numbers and statistics, the amount of contextual information given and also the number of sources or perspectives discussed.

#### *7.3.2.1. Technical detail*

For the first group of science students, technical details were not brought up as an important issue, probably because they were familiar with the scientific terminology and descriptions in the articles. However, students in the three other groups thought that certain articles were difficult to understand because they were too detailed or technical. There was sometimes consensus within a group about which article was too technical, but across the groups, all of the articles except for the pylon objectivity article were described as too technical by at least one student.

Most of Group 2, an arts group, thought that the GM objectivity article was too complex. Four out of the five students in this group also rated the objectivity article as the worst article prior to discussion (the fifth student did not respond).

> I thought B [balancing] was the best because it was less technical, more just kind of general…compared to A [objectivity] which has about three paragraphs where it is just explaining technical stuff, and it doesn't really mean much to somebody who's not actually doing that sort of thing.
>
> If I didn't have biology and chemistry and stuff in seventh form, I would have sat there going 'what?' I mean, stuff like 'bio-pesticides' and 'gene-carrying hybrids', and if you don't have a science background, you'd just get lost.

In contrast, Group 3, although they were science students, generally found that the balancing and weight of evidence articles were more confusing.

> There are too many technical terms [in the GM balancing and weight of evidence articles], and when I finished reading them I didn't have any points in my head. All I could remember was genetically modified corn and nothing else!
>
> For a newspaper article, I thought C [GM weight of evidence] was too technical...C is the one that goes into a lot of details that I wouldn't really require if it was a newspaper article.
>
> B [pylon balancing] differs from the others as it gives more scientific words like 'oxygen', 'nitrogen', 'air-borne pollutant', and that's going to affect some people as they don't know what the hell that means...yeah, 'benzene' and 'radon' and stuff like that. Not everybody is going to understand what they are.

One student in Group 4 (an arts group) also found the weight of evidence pylon article difficult:

> I got quite turned off C [weight of evidence] just by that first paragraph because there were so many big words in there, so when I started reading B [balancing], I immediately thought that was so easy to understand.

However, most of Group 4 generally commented on the clarity of both of the weight of evidence articles:

> I actually liked C [GM weight of evidence] the best because it was sort of fun, it was like a story they were telling. I think maybe because it was easier to read...maybe that one made me feel more safe with the subject matter.
>
> I actually liked C [GM weight of evidence] the best as well and I think because it had easy language to understand...and how it explained what things were, like it had a description of what toxins were.
>
> [The GM weight of evidence article] helped me understand the topic without being too complicated...The rest of them just focused on the arguments rather than the facts.
>
> C [pylon weight of evidence] is more just for your knowledge and you don't have to know what particles and ions and neutrons and all this is if you haven't taken science.

Since groups and individuals disagreed about which articles were complex and which were clear, it was difficult to identify exactly what types of information made the articles complex. Technical details were probably digested differently by readers depending on their individual backgrounds and knowledge of the topic. One reader commented that numbers and statistics made an article too complex and technical:

> The thoughts in the article [weight of evidence] don't stay with me because of the abundance of distracting and forgettable numbers...in it they are throwing all these statistics at you and I'm not going to remember those.

However, many of the students actually liked statistics and were instead bothered by technical words and concepts.

> I think statistics are quite compelling because they are a lot easier to understand than the scientific rational or method but at the same time...I know they can be biased, constructed to make you believe whatever they want you to think.
>
> You've got this advisory board on non-ionising radiation but is that a good thing or a bad thing? Do we want non-ionising radiation? Do we want ionising radiation? If you don't have a scientific background you'd just be going 'what?' I think C [pylon weight of evidence] puts it on, you know, a lay person level, even if they definitely do have more numbers and stats.
>
> I didn't mind the statistics [in the pylon weight of evidence article] because they were not hard statistics like things like non-ionising radiation...I don't know what that is.

Many students said that technical detail made them confused or caused them to become bored with an article. However, readers introduced two other potential effects that technical information might also have on readers. Some students thought technical details tended to scare people and made risks appear more acute:

> [The pylon balancing article] uses a lot more flash words like 'benzene' and 'radon'. I am sure it uses the words 'cancer' and 'leukaemia' about ten times more than the other two, and it is just trying to scare people I think.
>
> When you throw people more numbers and terms that they don't understand, they assume it is probably bad.
>
> I think that the way that A [pylon objectivity] is presented, they're trying to make you lost in the scientific bit...basically you just come out with this really horrid perception of not knowing what is going on but thinking it is definitely wrong or bad, because I don't think that most people have the determination to follow that article or the scientific background to make sense of that article.

Others commented that technical information can validate any perspective even if the reader cannot understand it:

> That's the sort of thing that freaks people out because they see lots of scientific words and chemicals and things and they think, 'oh well, it must be true because we don't know and the scientists do know'.
>
> I think that's sort of common to throw out heaps and heaps of statistics because I think it really distracts people from what is going on and they get lost in these numbers.

*7.3.2.2. Context and background information*

While many students criticised articles for containing too much technical information, in some cases, students wanted more detail in order to understand the issue at stake.

> The actual percentage risk would be kind of helpful. It [pylon objectivity article] just says 'elevated risk'. It used a lot of general words like 'more' and its like, how much more?
>
> I found C [GM weight of evidence] the best because it actually gave numbers of how much, what the toxicity of the Bt pollen is, and it actually gave an indication of how much pollen typically there was on the milkweed leaf, which the other two didn't give.

In addition, some students criticised the objectivity articles for not having enough contextual information, while they praised the weight of evidence and balancing articles for having better explanations:

> I didn't like A [pylon objectivity] very much because it didn't really give enough background, or it didn't really say what the study had really done.
>
> You can't really read an article and properly understand it if you don't understand the context.
>
> C [GM weight of evidence] also explained the background a bit more...so that kind of showed where the latest developments fitted in C.
>
> I also liked B [GM balancing] because they sort of set their problem in a historical setting by saying that it is an old problem.

However, other students recognised that incorporating more background and contextual information could create articles that were too long and complicated. For example, when one student expressed interest in knowing "how big the study was, how long it was conducted for, where it was conducted, more information on where they did it because of socio-economic factors," other students in the group said that this information was not appropriate in a newspaper. One student said "it would probably get too long," while another thought it would make the article too difficult.

Many of the students suggested that background information and other technical details could be presented elsewhere (e.g. on a website or in a feature article) and then linked to the news article for those readers who wanted more information.

> Links or something [would be good], just a mention of places where you could find more information if you so required it.
>
> Maybe something like a reference to a website for the university people who are doing research into this.
>
> I think it would be quite good to have a general article that outlines the debate and then have a feature page outlining in detail studies and things.
>
> Having an A [objectivity] type article with a small amount of technical detail...but having a C [weight of evidence] type article separate that could be accessed by someone who has a particular interest in it is also desirable, to keep...the deep technical detail that is quite hard reading separate from it and not to burden the A type article with too much of it.

*7.3.2.3. Number of sources*

In addition to the amount of detail and technical information that the article provided, clarity was also influenced by the number of perspectives that an article presented. Students expressed a desire for direct quotes, but they were overwhelmed when too many sources were quoted. Their comments suggested that an abundance of quotes could be confusing for several reasons. First, students had a hard time keeping track of too many sources. Second, they were also confused when too many different viewpoints were expressed.

> B [GM balancing] had way too many quotes but then A [objectivity] had none. C [weight of evidence] sort of had a good mix of quotes and information.
>
> I think that C [GM weight of evidence] was comparing too many various agencies...and I think that I was more familiar with the agencies that were being discussed in B [balancing]. That's why I liked it better.
>
> I believe that C [GM weight of evidence] has a lot more confusing things going

> on with a lot of scientific evidence from here and there and too many people coming in at the same time.
>
> I thought it [GM balancing] had way too many quotes, just this person said this, someone else said that. Just quotes all over the place.

### 7.3.3. Interest and relevance

A second factor that strongly influenced students' opinions of the articles was how interesting and relevant the article was to the reader. Some students suggested that an article created interest by covering an event or angle that captured people's attention. In particular, students recognised that newspaper articles are usually event-based, rather than issue-based:

> I think the science bits, people do want to know more about them, especially the likes of GM and the pylon stuff. It just needs to have some kind of angle to it, reasons why, not just 'this study has found links between something and something'.
>
> [The GM objectivity article] seems quite different to the other two. It is sort of a current newspaper thing and it is giving the information as background to something current that is happening, whereas the other two are about the original research.
>
> It seems like A [pylon objectivity] and C [weight of evidence] are reporting a different thing. The A one is somebody thinking something because something is going to happen...but the C one is just reporting the research. It's not anything that is immediately relevant to any particular person or any particular place.

Students also found articles interesting and relevant when they contained a human element or discussed how the issue related to people:

> If I was flicking through a paper and saw 'Protesters see risk to butterflies' [objectivity article headline], well I would be like who cares? There are better things to protest about than butterflies. It just wouldn't get me reading it at all...if this article had been put in front of me, I never would have read it, *ever*.
>
> If there is a human interest point of view then you're going to read it, you're going to keep reading, as opposed to ploughing your way through stats and figures and scientists' points of view.

Perhaps the most important feature that made an article relevant to students was having a New Zealand context. Many students felt that overseas research might not apply here, or they did not understand the potential importance of overseas research in their own lives, unless its implications for New Zealand were explicitly discussed.

> One of the main things that I liked about it [objectivity article] was that it put it into a New Zealand perspective...if you read the article you are interested in the effects on your own community and stuff and that one was more related to the New Zealand scene than the other two.

> When people read articles they sort of try to have a mental picture of what they are talking about, but if they are talking about America and all those places, Iowa University, you don't really know where that is and how that goes...I just thought that...most people would like reading A [objectivity] because it is talking about their country.

> I sort of got bored with it [balancing article] because it talked about pests like the bollworm and things I can't relate to, corn borer and stuff. It sounds like it wasn't a local thing, it was more United States orientated.

> A [objectivity] is based only on one research that was done in New Zealand, compared to nine studies that were done in Britain. But its just that the conditions in Britain might be different from the situation in New Zealand, so you can't exactly say the pylons here might have the same amount of radiation or effect on kids that it has in Britain.

Some of the students also said that they trusted local sources more because they were more familiar.

> I prefer local sources because over there it's different. It doesn't affect me as much and a local source is something that I am going to take notice of.

> I was a bit doubtful about Bristol University...because I've never heard of it...I thought more of the New Zealand National Radiation Laboratory and the World Health Organisation because it was more familiar than Bristol University.

However, this was not unanimous as one reader said that she trusted overseas sources more than New Zealand sources because she had a view of New Zealand as being less successful in science than other countries.

Although most of the students agreed that it was important for science articles to have a New Zealand context, they disagreed about whether a regional or local angle improved the article. One student thought that articles should have a local angle, since many people overlook national news:

> The only thing that I can see with A [objectivity] is that they go 'oh, it's a New Zealand article, we'll put it in the New Zealand section', which means that a lot of people skip that sort of section. They might say 'oh, there's something about my hometown, I'll read that' but they will generally skip the New Zealand or Australian news.

Another student spoke about her particular connection to the local context of one article:

> I thought article A [objectivity] was the best because it was about Wellington and I am from Wellington so I could kind of visualise where they are talking about. Also because I will probably end up working in schools, I just thought what would I do if I was working in a school close to a power pylon?

On the other hand, the specific context of that article alienated other readers because it was not relevant to them:

> In a sense it feels like okay, that's happening there, it's not happening here so it's not a problem.

> Article A [objectivity] is totally like the 'local blonde kid' in the backyard you know, and the fact that it is so extremely local doesn't give it as much importance. It sort of goes out of your mind because it doesn't have any worldwide importance.

### 7.3.4. Emotion and sensationalism

Although many students liked articles that were personal and that had a human interest element, these articles also tended to contain emotional language. A few students thought that this emotion was good because it made the article interesting for readers. They also noted that emotional language could help sell newspapers for this reason.

> ...you don't want to start reading academics in the newspaper. You want stuff that is I guess playing on the emotions of the human.

> Yes, the 'scientifics' have to be couched in emotional issues or all those people aren't going to read it.

> You always have to take into consideration what's going to sell this. Obviously 'Mother fears lines pose cancer threat' is like 'oh my god, I'm a mother, I have to save my child' so I'll buy the newspaper and save my child.

> They all just want people to buy their paper or magazine so of course they are

> going to do headlines like 'Mother fears power lines pose cancer threat'.

However, most of the students did not like emotional content, because they thought it was scare-mongering and sensationalism. In particular, students did not like the pylon objectivity article because they said that it played on the reader's emotions.

> A [objectivity] is quite different from the rest of the articles because it is presenting emotional issues...it involves emotional issues of how a mother would feel about her child being exposed to leukaemia.

> [The objectivity article] was so emotional and blatantly trying to force the whole connection between power lines and cancer...it's almost like if your child is in a school near power lines, you are a bad parent if you leave them there. It just seems to overstate everything.

> I think [the objectivity article] is a human interest story rather than what the real issue is. It's about cancer and power lines but instead we are just worried about people's emotions.

> I thought it was an emotive headline 'Mother fears...', but I feel that quite a few people will hook into that because it's personal...

Interestingly, a number of students also complained about the emotional language in the GM weight of evidence article.

> C [weight of evidence] has got the most details but at the same time there is what I would consider alarmist language in it. They refer to 'fear erupted a year later' and 'another alarming study relating to Monarch butterflies'.

> I think that the title for C 'Is GM corn a risk to wildlife?' is just to draw people in because it plays on your emotions more than anything but then the actual article is more balanced. Whenever anybody says anything like that they rush towards it and think 'Oh, what's going on here?' but really you know, it is just playing with people's emotions.

> I do agree that some of the language [in the weight of evidence article] is quite emotive...like 'fear erupted a year later'. I think it is trying to be too interesting and then perhaps not being quite as objective or careful as they should be.

### 7.3.5. Quality of Information

Most of the students found the balancing and weight of evidence articles more informative than the objectivity articles. In particular, students liked it when an article illustrated the scientific process or discussed the mechanism behind the proposed risk.

> Out of all the articles, it [the GM weight of evidence article] was the only one that did explain the ins and outs of what was going on and what findings different researchers had come up with and why the debate was going on.
>
> C [GM weight of evidence] also showed the scientific process they were using, saying 'oh well we did this in the lab and this may not happen in the field', so then they go out and do it in the field.
>
> A good thing about the C [pylon weight of evidence] article is that they are a lot more open so it is just teaching people to...take little bits of evidence as they come along and not just the first thing that comes to them and decide 'that's fact' and you are never going to change it.
>
> I thought it was cool how they [pylon balancing article] gave the explanation for why electricity can cause cancer.

Compared to the discussions of clarity and interest, though, surprisingly few students commented on the importance of the quality of information to the overall article. Many students said that they preferred the objectivity articles even though they recognised them as less informative, simply because they were more relevant or easier to understand. The articles that students in each group chose before discussion as the 'best' articles generally corresponded to the articles that they thought were the easiest to understand and the most relevant, not necessarily the ones that they thought were most informative.

Many of the students seemed to think that journalists face a trade-off between providing good information and creating an interesting and clear article. Moreover, given that choice, most students said they would prefer an interesting, clear article over an informative one. Most readers thought that the objectivity articles were the most interesting and clear but generally had the least amount of information. The weight of evidence articles (and sometimes the balancing articles) on the other hand were mostly rated as more informative but not as interesting or more difficult to understand.

> The problem is that if you write an article like C [pylon weight of evidence], a lot of people probably might not want to read C compared to B [balancing] or A [objectivity], but it presents the facts better.
>
> It [pylon weight of evidence] has more facts in it, it's unbiased, but for a newspaper article I found it really horrible to read. It's confusing, there's lots of angles, they're bringing in lots of research, lots of numbers. I wouldn't read that one. For A [objectivity], it is more biased, more subjective and all but it is less confusing to read.
>
> If I was trying to find evidence for this [effect of pylons] then C [weight of evidence] would probably be better, but if you look at C, the first sentence is three lines long...If they want to get your attention it should really be shorter.
>
> For a newspaper article, A [objectivity] is much less straining...Maybe if I'm supposed to teach someone, I won't teach this [pylon objectivity article] to my students...but if I am going to get up early in the morning and read the newspaper, I would rather like knowing what is really happening rather than going into the laboratory.

Although students in Group two identified the weight of evidence articles as the most informative, they did not think that newspapers should run more weight of evidence type articles because they said that people were not interested in such in-depth articles. Similarly, none of the students in Group three thought that the pylon objectivity article provided readers with enough information for them to make an informed decision about power lines, even though three of the seven students rated it as the best article. In contrast, only one student said that it was more important for an article to be informative than to be easy to read.

Students also noted the dual roles of the media as both sources of information and entertainment and the tension that their need to sell newspapers can create.

> It's an inherently difficult occupation because the Sunday paper is boring if its just full of C [weight of evidence] articles, but if it is full of A-type [objectivity] articles, that's what sells.
>
> You could go and if you were really interested, you could find out more yourself and read scientific evidence. But why would you want to read that in a newspaper...?
>
> Its all about whether it is for entertainment though, which is really what newspapers or news are most of the time, rather than actually information. I guess if people really do want information about something they can seek it out.

> I think that journalism in general should not just try to sell papers and should try to inform, that's basically the guideline to journalism.

### 7.3.6. Objectivity

The final factor that students identified as important in creating a good science article was objectivity. Students discussed various facets of objectivity including factuality, lack of bias, balance and fairness.

#### *7.3.6.1. Factuality*

A number of students said that it was important that an article have facts, rather than just people's opinions. In general, the students thought that the weight of evidence articles in both cases were the most factual, whereas the objectivity articles, especially the pylon one, were mostly subjective and based on opinions.

> [The GM weight of evidence article] was more informative. It had both sides of the argument right from the beginning. The other two were just opinions, where all the time it was this person says this, this person says this.

> It [pylon objectivity] had no facts to back anything they were saying up anyway, like even though they were saying 'oh, the study found that this caused leukaemia in children', it hasn't really got anything there to say that it actually did.

> I reckon C [pylon weight of evidence] was the better one because of the stats. It just put a better picture in my head of how many kids...and the risk between power lines and [cancer]...It [the pylon objectivity article] is just a mother going on about her child really. I mean I know it is relevant but just with research, it helps back it up – that there is a link rather than a lady worried that there could be.

> I find it a bit frustrating when I just get opinions of people...and unless they've also explained the ins and outs of the issue and the facts, I can't really draw a conclusion myself. I don't really trust people, even if they are a scientist...if it is opinion, then I'm not really learning anything I don't think.

#### *7.3.6.2. Balance and bias*

All of the groups had lengthy discussions about balance and bias, and most students thought that all journalists should try to balance articles and be unbiased. One student said that articles "need to be presented in a balanced way so it's not all just scare mongering or one-sided" and another thought that to judge a claim, the reader "needs all points of view".

However, although all students agreed that a lack of bias was desirable, they disagreed about which articles were biased and even which side the articles were biased toward. For example, some students thought the GM objectivity article omitted the pro-GM viewpoint, but other students thought that the article was biased toward the pro-GM side because it belittled the protestors against GM.

> I don't think article A [objectivity] has much about the people who are for genetic modification.
>
> I think A is definitely more pro-GE...when they are talking about 'claims by this resident' or 'perceived dangers', they're making it seem like people are jumping the gun and getting hysterical about nothing, whereas they're presenting their company as being all calm and collected and knowing what they're on about.
>
> I actually thought article A was a bit more suggestive in the heading because it says 'Protestors see risk to butterflies' which implies that the protestors – which are Greenpeace – are somehow subversive and being a bit ridiculous and over-reacting to protect the butterflies.

Similarly, students variously thought the GM balancing article was pro-GM, anti-GM or neutral.

> For me, article B [balancing] was one of the worst because it seems that for the entire article it presented a very one-sided argument. In fact, if you look closely at it, it seems that almost three quarters of the article seems to be dedicated to its convincing the reader that GM corn seems to pose some sort of risk.
>
> I think B came across more strongly in favour of the corn growers. The facts that might appeal more to people are the ones that were in favour of the corn growers so it didn't seem balanced...
>
> I thought that B was quite neutral. It had a balance of quotes from either side and both sides of the argument were fairly evenly weighted.

More students agreed that the GM weight of evidence article was balanced and unbiased.

> [The objectivity article] is for GM, clearly for it in the last sentence, and [the balance article] is against, and...I haven't made up my mind about C [weight of

> evidence] so maybe C is more neutral.
>
> I didn't get the feeling at all that it [weight of evidence article] was pushing me in one direction.
>
> I think that C [weight of evidence] balances itself out pretty well...It's kind of balancing itself out by saying 'in lab conditions' and 'in the real world' don't always coincide, so maybe the tests and lab work aren't totally indicating what is going on in the real world.

However, there were still students that felt strongly that the weight of evidence article was biased against GM, although this bias was based on emotional language rather than a lack of balance:

> I felt the words [in the weight of evidence article] – the 'harmful', 'fear', 'another alarming study' – was telling me that this is all bad and take that side.
>
> It seems like although they have presented the facts better than the other ones, they've already made their mind up against GM.
>
> C [weight of evidence] is written with more of a bias...I mean, all of those emotional words...like they want you to hate genetically modified corn basically.

In contrast to the GM articles, most students agreed that the pylon objectivity article was very biased and that the weight of evidence article presented a more balanced picture.

> I would agree with everybody else that A [objectivity] seems very biased, especially the opening two paragraphs...it quoted one person the whole way through.
>
> I definitely agree with article C [weight of evidence] being the better one because it has more definite statistics and it is more balanced between negative and positive evidence...A [objectivity] was just completely subjective and it wasn't scientifically based. Most of it was negative propaganda and it felt like there was an agenda against Transpower.
>
> I thought that article C [weight of evidence pylon] was actually one of the best because arguments given within the article seem to be pretty balanced out, instead of article B [balancing] which seems to jump at inconclusive facts.

A few students commented that the pylon weight of evidence article was a little biased. These students were suspicious of a journalist telling them *not* to worry about a risk. Their comments suggested that even if a journalist had good evidence that a risk did not exist, some students would still have preferred to have had the risk overstated just in case.

> I thought when I first read it [weight of evidence article] that it was a bit biased the other way, that it was kind of going to allay people's fear of [power lines]...you could read into it as a bit of a cover up...
>
> I would rather err on the side of caution and have a risk slightly overplayed than to have it down played and find out 20 years later that hey, you know I went out and bought a house under a pylon and now I have cancer. I'd rather have [them] say 'hey, there isn't a proven link yet but there is a possibility' than have them say 'if there is a link it's very, very weak and you're not going to die of cancer'.
>
> I think that whenever there is a study about anything these days, you start to think that it is already bad because why else would they study it?...It is hard to accept that there is nothing wrong.
>
> If one says that there is a link between cancer and pylons and one says there isn't, I guess it would be cautious to say that there is and make sure that you don't have a house near pylons.

One student observed that it sometimes might be difficult for the reader to recognise bias in a story when only one viewpoint is given.

> I think the thing that we need to be careful of is the only reason we can identify A [objectivity] as being biased is because we also have B and C in front of us...we can only identify that A is one-sided because we have both sides presented in front of us.

Other students also recognised that the opinions and knowledge of the journalist have a big effect on the way that an issue is presented to readers, and that the journalist is influenced by various other people and normative dimensions of their job.

> There is always political pressures on what they report, especially sometimes their boss or editor would have a different opinion and they might be forced to write it towards that opinion.
>
> I think it is more usually funding...
>
> ...if it is a scientist who thinks it [GM corn] is a problem...and say they get in touch with this journalist and the journalist thinks 'oh it must be really bad' then they will just focus on that anyway. That's what tends to happen in the newspaper.
>
> Bias is usually introduced by the person writing the article because they have some kind of agenda against it, or the person who contacts the newspaper...like

> obviously this mother [in the pylon objectivity article] probably contacted this newspaper and because she's got a negative viewpoint the reporter would have taken it from a negative viewpoint and researched it from that [view]...
>
> Newspapers just give you the facts but it's their slant of the facts.

### 7.3.7. Comparing the approaches

#### *7.3.7.1. Objectivity approach*

Even when only one point of view was given (i.e. the objectivity articles), some students found it confusing when a single source seemed to be taking both sides. In the pylon objectivity article, students were confused that one source said that there was only a small risk of cancer from power pylons but yet he also said that he would not advise children to live near power lines.

> [The objectivity article] left me feeling quite confused, especially when a guy says 'it's not that much of a concern, it's so small, but I personally wouldn't advise any children to live there'. It's such a contradiction.
>
> It [objectivity] does seem a bit inconclusive. You're not sure if it's warning you. It seems a bit ambiguous.

One student said that he liked having only one point of view presented:

> I think you are kind of getting spoon fed the ideas [in GM objectivity] but to make up your own mind you have to get a comparison of the different views to start with...you kind of need a standard to go by first before you can really make an informed decision.

However, all of the other students that discussed the one-sided approach did not like it because they felt the journalist was telling them what to think:

> I hate A [objectivity]. Seriously because there are so many people out there who are so accepting of stuff like that...and people are too easily led to be able to handle stuff like that...
>
> It's not necessarily telling you what to think, but it...generates you to think about it in a certain way because it's just presented as just one side.

One reader thought the one-sided approach could have the opposite effect by making the reader suspicious of what the journalist had left out.

> I think leaving out information can kind of act in both ways depending on how it is written. If you've read an article that is obviously biased and obviously only has one point of view, for me it tends to make me agree with the non-represented side, because it feels like they're hiding something. But then if you are given enough information so that you can see both sides but it is still pointing to one, it can definitely suggest a point of view.

#### *7.3.7.2. Balance approach*

One science student indicated that he thought it might be confusing for non-scientists to have a balanced approach. However, as noted above, the students were generally very opposed to any suggestion of bias or one-sidedness by the journalist. Most of the group discussion focused on the benefits of a balanced approach, which they thought enabled readers to make up their own minds.

> I think it [GM balancing] makes it less [difficult for the reader to make up their mind about GM] because you don't have more of one side's information than the other point of view.

> Surely people that don't do science can still make up their minds about that kind of thing.

What meaning did students derive from the balanced approach then? The first way that students seemed to interpret the balanced approach was to assume that the science discussed was uncertain. Several students suggested that writers could use opposing sides to illustrate how uncertain a scientific topic is. In other words, they interpreted controversy as uncertainty.

> They need to make more of a point that this situation is actually unclear…instead of taking the view of either way, just saying that no one really knows for sure at the moment.

> …if you have conflicting information then perhaps your claim isn't well-supported.

The second way that students interpreted the balanced approach was to assume that the truth actually was somewhere in the middle of the two opposing sides.

> Usually if there is one study is not a significant link and the other is a little bit of a link, I usually think that the truth is somewhere in the middle and just sort of think that there must be a little bit of a possibility but nothing too magnificent.

> You don't feel like they [weight of evidence pylon] are saying there is no risk or there is a full-on risk. It feels as if it has been presented more truthfully.

Most of the students were confident that they could interpret the evidence in the articles themselves.

> ...I think if they were just basically presenting the results of the research and even if they are diametrically opposite then it doesn't bother me because I can weigh up the information and come to some sort of conclusion even if it is only that they don't know what the answers are.

In some cases the students did evaluate the competing claims based on an evaluation of the scientific studies supporting them. For example, students were able to compare two opposing claims about the risks of cancer from power pylons by noting that one study examined the risk to power workers, while the opposing claim focused on children.

> I think in a way the comment about the workers is misleading because...these electrical people are working with the [pylons]. Obviously someone repairing the power lines will have more risk certainly.
>
> I would have thought it was pretty logical that you probably would suffer from radiation if you were in a lot of contact with things like power lines...whereas taking a broader cross section of society it is harder to have any more definitive results because there are too many other factors. So yeah, I think they are both valid. I just think they need to be qualified.
>
> For me the studies are two different things because one is about adults working and sustaining regular contact, the other is exposure of children. The two examples are poles apart in my thinking.

However, the students in the focus groups seemed to more often judge opposing claims not based on scientific evidence but rather based on how much they trusted the sources. Official qualifications were an important way that students judged which sources should be trusted over others. For example, one student said she would trust a doctor over a university lecturer, and others trusted scientists over companies or industry.

Students also recognised that their judgements of truth claims were influenced by their own background, experiences and knowledge of the subject:

> ...all readers are different. People see things differently. What we might think

> might be different to what other people...other readers may look at it in a different, completely different way.
>
> It depends on the particular subject. With the GM thing a lot of people are inherently sceptical about it so it sort of changes what you think...you can just always think that it is bad even though someone can say that it is good and give you all this information...

Finally, some students thought that the only way to judge truth claims effectively was to read more widely about the subject. These students tended to see the media as inherently biased, and so they thought readers could only get a balanced view of the different perspectives by reading stories by different journalists.

> You've got to depend on other articles. If it is a big issue, chances are its going to be reported quite a lot in newspapers...you just have to look at the work that is quite closely related to their opposing views and see how that work supports either of the views. That's how you can judge it.
>
> You have to read articles written by two different people and get two viewpoints.

*7.3.7.3. Weight of evidence approach*

Interestingly, none of the students in this study differentiated between the balancing and weight of evidence articles in terms of their overall evaluation of the weight of evidence. Instead, most students thought they were different in terms of style, bias, or technical detail. Most students thought that the balancing and weight of evidence articles had similar levels of information but were simply organised differently. The only indication that students were able to distinguish between the two types of approaches was that some students commented that the balancing articles were "jumpy" or skipped among unrelated facts, whereas the weight of evidence approach seemed more coherent and clearly organised. Therefore, students said it was easier to compare the different points of view in the weight of evidence articles than in the balancing articles.

> I had to flick around a bit just to compare the paragraphs [in the balancing article].
>
> I found [the balancing article] confusing because they kept on switching the focus of whoever was speaking...the argument seemed to be jumping quite a lot.

One student did suggest that journalists could use a weight of evidence approach to help readers judge truth claims, although she did not think any of the presented articles used the approach completely.

> ...they need to somehow let the reader know whether it is a really big study and does it have a lot of evidence, or whether it was quite a small study, like say it only had eight subjects and it was in another country. Somehow they need to get across how far you are going to take the evidence...It was like the pill or something like that...they picked up on this small fact and it became this huge big deal but they never really got across to people what studies were done and how much it is a problem.

In discussion, other students in this group agreed that the weight of evidence articles they read were "moving more toward this approach", but they also agreed that the approach was negated by the fact that the weight of evidence articles were boring and too difficult to read. It was unclear whether they thought that this approach would necessarily require a trade-off in clarity or readability, or whether these particular articles were just poorly written. However, the group did agree that in real life, journalists do not use the weight of evidence approach, particularly in news stories. Several students thought that it was more appropriate for a weight of evidence approach to be used in magazine articles or longer feature articles than in news articles. They said that the weight of evidence articles had a different language and style and that they focused on issues rather than events.

Journalists in the survey (see Chapter 4) suggested that a further criticism of the weight of evidence approach is that it introduces journalistic bias, rather than letting readers judge claims for themselves. The students in this study also stated quite adamantly that they did not want journalists making decisions for them. They wanted to be presented with both (or all) sides of the issue so that they could make up their own minds.

> When it comes to perceiving events, does anyone really want to be told what to think? I want to have two sides of evidence, *all* the evidence, not two sides of 'one side's right' and 'one side's wrong'. With the sides presented in front of me, I can make my own choices rather than having any particular view of the writer forced down my throat.
>
> I think I should be able to read it and decide for myself whether I should worry, and if you are going to try to persuade me either way then I am not really going to think the article is as valid.

However, most of the students said that the weight of evidence articles were best at leaving it up to the reader to decide. Students thought this approach – rather than "telling them what to think" – enabled them to make an informed decision, in contrast to the objectivity approach which only offered one view.

> The way the others [GM objectivity and balancing] are written, they are just trying to argue. They are not trying to let the reader make up their own minds, [they are] saying this is what we think, this is what we think you should be thinking.
>
> [The weight of evidence article] starts off with a question. It puts it out there. It doesn't say one way or another...It kind of inspires you to think about it.
>
> C [GM weight of evidence] is good because they have the article but then they've got 'it is an inherently difficult subject to study and results are conflicting', which basically says you can make up your own mind what you want to believe.
>
> I actually liked how [the GM weight of evidence article] was inconclusive, how it kind of left the reader to think more and not come up with a definite yes or no.

A few students did think that the weight of evidence GM article was leading them to oppose GM, but this bias seemed to be based primarily on flowery language rather than on journalistic evaluations of the evidence (see section 7.3.6.2 'Balance and Bias' above).

## 7.4. Discussion

### 7.4.1. Factors affecting student perceptions of science news

Much of the literature on the public understanding of science and science communication focuses on how to make science digestible for the general public (e.g. see Blum and Knudson 1997). These focus group discussions indicate that this is an important endeavour since the primary way that these students evaluated the newspaper articles was based on their interest and ability to easily understand the articles. You might expect students (especially science majors) to be more concerned with the scientific facts than the general public on average. Yet surprisingly little discussion was devoted to information content compared to their interest in and comprehension of the articles. Many students saw a trade-off between readability/interest and information content, and in most cases, they thought readability and interest were the more important factors. Hipkins et al (2002, p. 3) also noted in their study of New Zealander's attitudes towards science that "there is a tension between the provision of validating detail and the necessity to retain interest and engagement of a non-science audience."

Students said that they were interested in an article when it was somehow relevant to their lives, which reflects a more general desire by most audiences to have a personal stake in their news (Nelkin 1995). Much has been written about this need to make science relevant to people, for example by illustrating the scientist's life or creating some other human interest angle to the story (Nelkin 1995; Shoemaker and Reese 1996), although sometimes this may come at the cost of omitting contextual information that would explain the significance of the science (Blakeslee 1986).

In addition, the focus groups also indicated that one of the most important ways that science can be made relevant to people in this country is by ensuring that the article has a New Zealand context. This could include having comments by New Zealand scientists, explaining what work is being done on the subject here, or how overseas research might apply to New Zealand circumstances. The importance of a New Zealand context for students is particularly noteworthy given the preponderance of overseas-sourced science stories found in the content analysis of New Zealand news (see Chapter 5).

The level of technical detail in an article seemed to have the greatest effect on the students' ability to understand the article. Students were confused or distracted by technical terminology and unfamiliar concepts (and sometimes by numbers and statistics, although many students found them compelling rather than a deterrent). Rogers (1999) also found that her focus group participants were easily confused by technical words and concepts. In her study, participants were eager for more explanative details. In contrast, many students in this study had more complex reactions. They were torn between wanting an easy, simple story that they could face over breakfast and yet also wanting a story that was not "dumbed down" and that gave them contextual and background information.

The solution that some students found was for journalists to provide links from a short and simple news story to other places where readers could get more information if they needed it. For example, links could be made to longer, more explanative feature articles or to websites. In some ways, this solution provides a good compromise between providing interested readers enough information and yet not confusing less interested or knowledgeable readers. However, this solution does not solve a more fundamental problem that usually most readers will not seek out those other sources of information and so will continue to rely only on the short article to make their decisions. Thus, the journalist does not escape the conundrum of needing to provide readers with accurate, adequate and appropriate knowledge in as short a space as possible.

Objectivity was the final factor that emerged from the focus group discussions as an important feature of science articles for students. Students did not talk about 'objectivity' per se, but discussed various aspects of this concept such as balance, lack of bias, factuality and fairness. Regardless, all of the students had an expectation that the journalist should be removed from their subject, reporting only facts in an unbiased, fair and balanced fashion. Students wanted the journalist to provide them with both sides of the issue (or even *all* perspectives on the issue) in order to allow them to make up their own minds.

### 7.4.2. A comparison of responses to strategies for reporting controversy

Since the students so strongly desired a balanced and unbiased approach and did not want to be told what to think, you might expect that they would have greatly preferred the balancing approach to the weight of evidence approach. However, many of the students explicitly identified the weight of evidence articles as the ones that best enabled them to make up their own minds. Their discussions indicated that they felt the weight of evidence articles were the least subjective, because they enabled the reader to make informed decisions.

It is possible that the specific articles used in this study made readers think that the weight of evidence approach was objective. The focus group discussions indicated that these students were happy with a weight of evidence approach so long as they felt that the journalist remained impartial about the subject, and in this case, that was relatively easy for the journalists to achieve. For subjects such as genetic modification and the health risks of power pylons, the science is still relatively uncertain. Thus, a weight of evidence approach came to conclusions similar to those that readers derived from the balanced articles: more research needs to be conducted and the truth is probably a compromise between the opposing truth claims (i.e. there may be some risk but it is probably small). Indeed, the students mostly did not recognise the difference between a weight of evidence approach and a balancing approach in terms of content. However, some students indicated that they found the organisation and structure of a weight of evidence approach easier to understand.

It would be interesting to investigate how readers might react to a weight of evidence approach when the scientific evidence is more certain. For example, some aspects of climate change, such as the theory of the greenhouse effect and dramatic increases in greenhouse gas concentrations over the last 250 years, are well-established certainties, even though they are often presented as controversial by the media (Wilson 2002). How would readers react to this less partial stance, particularly given the propensity of students in this study to be suspicious when a risk was down-played?

Most of the students felt that they could judge scientific truth claims by evaluating the evidence for each claim themselves. However, in reality this usually meant judging the qualifications of the sources rather than their scientific evidence. Judging how qualified a source is to comment on a scientific claim in many cases may be critical to evaluating the truth of the claim. Journalists may often ask scientists to comment outside their area of expertise (Dunwoody and Ryan 1987), and Weigold (2001, p. 181) suggests that journalists often adopt a much broader view of who is qualified to comment on scientific issues (e.g. political activists or interest groups) than scientists do. Science coverage can also sometimes be dominated by industrial and corporate sources anxious to promote their products, without a critical questioning of their motives (Priest 1999).

However, source credentials are not always sufficient to judge the validity of a claim, as even the most prestigious scientists are wrong occasionally. Moreover, judging credentials will always give credence to scientists who work for mainstream institutions, or what Hall et al (1978) call "regular institutional sources". Goodell (1987) notes that this reliance on a small number of established 'experts' may result in media coverage that "reflects the values of the scientific community, with relatively little of the compensation, scepticism, and investigation that customarily accompanies political reporting." Hall et al (1978) also suggest that a reliance on institutional sources means that those already in powerful or high-status positions are likely to have their opinions about controversial topics accepted over others. It may also be easier for scientists at institutions to control or manipulate the media, because they can rely on public relations personnel who understand how media routines operate (Shoemaker and Reese 1996). On the other hand, on certain issues such as biotechnology where public trust in the involved scientists or institutions has failed, non-official sources may be believed simply because they are challenging institutions that have established negative images and reputations (Priest 2001).

Additional information besides source credentials could therefore help the audience evaluate competing claims more effectively. For example, audiences might need to know how the research fits with previous scientific studies, what questions remain to be answered, what the methodology of the research was and what conclusion the majority of scientists support (or indeed if there is a scientific consensus at all). Hipkins et al. (2002, p. 40) found that when people were asked what they would want to know about an issue if they thought it might affect their health, 14% of the surveyed New Zealanders said that they would want to know about "research that has been done, with further comment about the reliability and/or sources of information about the issue, enabling them to judge its merits." Students in the focus groups in my study also showed that they could use such information to evaluate opposing scientific evidence. For example, students recognised that a study on the effects of power pylons on power workers could not necessarily be extrapolated to the effects on children.

Although this study suggests that an evaluative, or interpretive, framework can help readers to understand controversial scientific claims, there are several questions that need to be explored in greater detail. First, university students may be more able (or at least feel more confident) to evaluate scientific evidence than much of the general public. Would less educated readers understand comparisons of evidence or explanations of the data in the same way, or would they need far more explanation and interpretation than these students? If so, would journalists be able to present this additional information and interpretation without suggesting to the audience who to believe?

Another question that needs to be examined is whether audiences would actually *use* evidential information to judge scientific claims if it was presented, or whether they would continue to use other criteria such as source credentials that are easier for them to evaluate. People have various ways of assessing scientific information, including their trust in the information sources (Frewer et al. 1999), and it may be that audiences would continue to judge claims based on factors other than scientific evidence. For example, several studies have shown that having more information about a risk does not necessarily decrease the public's opposition to that risk (Evans and Durant 1995; Priest 2001). On the other hand, a recent focus group study in New Zealand found that participants did consider the scientific evidence when evaluating information from internet excerpts (Hipkins et al. 2002). However, they also considered other factors such as whether the information concurred with their own knowledge or observations, whether they believed the source of the information was credible and whether the excerpt was "reader-friendly".

A final issue that could be examined is the appropriateness of using the weight of evidence approach in news articles versus feature articles or magazine stories. Despite being from an educated sector of the population, the students in these groups largely thought that the weight of evidence articles did not fit their idea of what a newspaper article should be, and that this approach would be more appropriate in a popular science magazine. Indeed, the GM weight of evidence article was adapted from a *Scientific American* article and the pylon weight of evidence article was adapted from a newspaper feature article. Thus, readers probably recognised that their language and style were different from a news story.

However, the discussion also indicated that some students thought that the approach was not appropriate for news stories, because weight of evidence stories are usually long and detailed and they tend to focus on an issue and body of research rather than on an event. Journalists that were surveyed also thought that the weight of evidence approach was more appropriate in feature stories (see Chapter 4), and the content analysis showed that weight of evidence science stories were significantly longer than other print stories (see Chapter 5). This distinction needs to be examined more closely to determine whether the weight of evidence approach inherently requires longer, more detailed and issue-based stories.

# CHAPTER 8:

# DISCUSSION AND CONCLUSIONS

## 8.1. Science news in New Zealand

The first goal of this thesis was to describe the current status of science reporting in New Zealand. Data from a survey of journalists and a content analysis of science news were used to describe who reports science for the New Zealand mass media and what type of science coverage they produce.

### 8.1.1. Science reporting without specialists

This study shows that science is not a specialist subject area for most mass media organizations in New Zealand. Only five reporters had a dedicated science round at the time of this study and all of them covered other rounds in addition to science. Thus, perhaps the country's only true science specialists are a few freelance journalists, a handful of journalists who write for specialised scientific, environmental and medical publications and a single National Radio journalist who produces the country's only dedicated science programme.

As a result, most science in the New Zealand media is covered by the many journalists who cover related rounds such as environment, health and medicine, agriculture, computers and IT. Correspondingly, medical, environmental and biological topics receive the most coverage, while the physical sciences in particular receive little coverage. These results accord with New Zealand journalists' perceptions of what topics should receive the most coverage, as well as with other studies from around the world that show that medicine and the life sciences are the most frequent science news topics (e.g. Dennis and McCartney 1979; Meadows 1986; Hinkle and Elliott 1989; Meadows and Hancock-Beaulieu 1991). This suggests that journalists worldwide share a common perception of what science topics are most newsworthy. Moreover, these preferences seem to be shared by news audiences. In a recent public survey, Hipkins et al (2002) found that the scientific topics that New Zealanders had the greatest interest in were new medical techniques and treatments (81% interest) and saving endangered species (81% interest).

The journalists who report science in New Zealand tend to be interested in the subject, but they have little or no science training and have been covering science for a relatively short time. They also spend little time reporting science, most less than 20 hours per month. Also many of these reporters are young and relatively new to the journalism profession (a third had been a journalist for less than 3 years).

Many other small countries share this lack of specialist science reporting (Einsiedel 1992; Eide and Ottosen; Saari et al. 1998), because all specialist reporting requires considerable resources (i.e. staff and money) that are not available to most small news organizations. Similarly, Perlman (1974) found that science specialists are more common on large and more economically successful US newspapers than on small papers. Adding to these constraints, New Zealand has a particularly competitive, deregulated news environment that forces news organizations to maximize profits and minimize costs (Comrie 2000). In this environment, it is nearly impossible for small specialty reporting to thrive if the subject is not accorded a high news priority.

The lack of specialist science reporters in New Zealand is a disadvantage because journalists have less time to spend on the subject and they accumulate less experience reporting science. Einsiedel and Coughlan (1993) found that Canadian full-time environmental writers were more likely to produce longer stories, more analytical stories, to include background information and to recognise uncertainty than general reporters. Wilson (2000) also found that full-time science reporters had more accurate knowledge of climate change than reporters who covered science part-time. Moreover, the lack of science rounds means that science may not receive as much coverage as topics that fall neatly under dedicated rounds, and when science does hit the front page (e.g. Corngate; see Chapter 3), the story is likely to be passed on to a general reporter who is unfamiliar with science reporting altogether.

On the other hand, several studies suggest that other factors may be more important than specialist rounds in determining the quality of news coverage. Wilson (2002) found that even full-time weather forecasters had considerable misunderstandings of climate change science. Similarly, Logan et al. (2000b) found that the overall editing and reporting standards within a news organisation influenced long-term news performance more than specialist beats. Treating science as a specialist subject also has other disadvantages. In particular, treating science as a discipline separate and distinct from other parts of society reinforces the public perception that science is not relevant to everyday life (Metcalfe and Gascoigne 1995).

### 8.1.2. Sound bites from overseas

The distinguishing feature of science news in the New Zealand media is not its infrequency (as some scientists have bemoaned), but rather that so many stories are short and that so many originate from overseas wire services and news organisations. News from wire services may be appealing to news organisations, because such news is relatively cheap and easy to obtain and because it is already in a form that does not require much further sub-editing. In addition, wire services tend to focus on research that has been published in high-status, peer-reviewed journals, and the wire services themselves also have an accepted reputation as credible suppliers of news. This means that news organisations that import stories from the wires may be satisfied that the stories they receive are accurate and do not require further checking.

The abundance of overseas science stories in the New Zealand media is related to the short length of science news here, because overseas stories were significantly shorter than New Zealand stories. It seems that editors view science as a good 'filler', and quirky or unusual science features may get whittled down to a few sentences about a peculiar finding.

Story length is important because short stories were significantly less likely to contain contextual information that could help the audience understand the significance of a scientific claim. As a result, science news simply becomes a series of disjointed discoveries, rather than grappling with the many complex scientific issues that affect people's lives. Short stories were also significantly less likely to contain multiple sources, who might substantiate the claim or offer different perspectives.

The fact that so much of science news in New Zealand comes from overseas may also have implications for the way that people view science. First, audiences may perceive that little important scientific research occurs in New Zealand. This could ultimately result in a lack of confidence and support for science here, or it could simply distance science and the public by describing science as a pursuit that is far removed from most New Zealander's lives.

In addition, audiences may have trouble interpreting the significance of overseas studies to their own lives. The focus group study suggested that relevance is one of the most important factors to readers of science news. Students in this study had doubts about how applicable overseas studies were to New Zealand circumstances, and they wanted more information from familiar sources.

Finally, the importation of science news is important because it places a large amount of control over the news in the hands of wire editors. Overseas research suggests that editors often have different attitudes, opinions and priorities from reporters and scientists (Breed 1955; Johnson 1963; Epstein 1974; Nelkin 1995). In addition, editors are even less likely than reporters to have a science background, and they tend to be more concerned with colour and interest than accuracy (Johnson 1963). As a result, science coverage may not pass through the same set of "critical filters" that other news must pass through (Einsiedel 1992, p. 79).

## 8.2. Verification and balance in New Zealand science news

The second goal of this thesis was to look at the relationship between the constraints that New Zealand journalists work under and the way that science gets reported. In particular, two noteworthy patterns emerged from the content analysis: an abundance of single-source stories and the tendency to balance opposing claims in a ''he said, she said' manner.

### 8.2.1. Single source stories and a lack of controversy

Independent verification was rare in this study; 68% of the 682 stories about scientific claims contained only one source. Moreover, in the survey of New Zealand journalists who report science, 25% said that they typically go to only one scientific source for science stories. This seems surprising given that verification is an important journalistic practice and that verification is typically conducted by consulting with multiple sources (Tuchman 1972; Goodell 1987; Nelkin 1995). However, this reliance on single sources for science news has been documented in numerous other studies from various countries (e.g. Weiss and Singer 1988; Bell 1994a; Eide and Ottosen 1994; van Trigt et al. 1994; Friedman et al. 1996). In a study of New Zealand broadcast news, McGregor and Comrie (1995) also found that the average number of sources per story had risen from 1985-1994, but 45% of the stories still used only one source by 1994.

Journalists may also have other methods for verifying claims, such as checking documents or previous media accounts. However, the content analysis found only 24% of stories showed any evidence of verification through any of these methods. Moreover, the number of stories with multiple sources provides an over-estimation of verification, because sources are used for a variety of different reasons, not just for verification. For example, interviewed journalists in this study suggested that they use multiple sources to create visual or auditory interest or to please their editors. Similarly, Conrad (1999) found that scientific experts were used to give context, to legitimise the findings of a study, to explain a scientific finding and its implications, or for balance.

In addition, news pieces that discussed maverick science claims, which could be considered the most crucial claims to verify, were unlikely to be critical of the claims. Although coverage of maverick science was uncommon (only 13 stories focused on maverick claims), all but one of the maverick stories relied on only a single source.

Moreover, less than half of the stories with more than one source in this sample included dissenting opinions. Thus, despite criticism in the literature that suggests the media overemphasise conflict between scientists (Cole 1975; Efron 1985; Burnham 1987; Miller 1992; Wilkins 1993; Dearing 1995; Wilson 2000), conflict and controversy were uncommon in this sample of New Zealand science news. Logan et al.

(2000b) found that two American newspapers also rarely presented science stories with an embedded motif of conflict, dispute or argumentation. Similarly, Conrad (1999) found that multiple sources were mostly used to insert "cautionary notes", qualifications or limitations about a new finding, rather than to present opposing sides.

One important limitation of this study was that I only searched for evidence of verification within the news items themselves. It is possible that journalists sometimes verified claims but did not include that information in their story, or that the information was removed during the editing process. I assumed that, given their limited time constraints, an entire perspective was unlikely to be omitted by the journalist if s/he had made the effort to check with an additional source. Similarly, editors may be unlikely to remove sources from a journalist's story because verification helps establish the credibility of the claim and protects the news organisation from accusations of inaccurate reporting (Boyer 1981; Fuller 1996). However, news stories tend to be cut from the bottom upwards, and so sources that were near the end of the story may have been eliminated.

A second limitation of this study is that it did not follow the coverage of stories through time, and thus it may have missed opposition to claims that emerged later. Presenting opposing views over subsequent days is a common practice and one endorsed by the Broadcasting Standards Authority regulations. For example, Paul Norris (1997), Head of the New Zealand Broadcasting School, Christchurch Polytechnic and a former Director of News and Current Affairs at TVNZ, says about New Zealand's most popular current affairs show, "Holmes often takes one side of an issue one night, followed by a response or an alternative view on the same issue the next night, or even the following week." Nonetheless, the content analysis should have detected such coverage if it had been a common occurrence, since any subsequent stories would normally make reference to the fact that it was a differing opinion from the original story.

### 8.2.2. The balancing strategy for conflicting claims

Although conflicting scientific truth claims were unusual in New Zealand science news, the content analysis (Chapter 5) shows that journalists tended to handle conflict by balancing the claims against each other using a 'he said, she said' approach. Furthermore, journalists tended to polarise the controversy, by pitting two opposing truth claims against each other. Journalists very rarely presented contextual information to help the audience decide which claim was supported by either the majority of the scientific community or by the most scientific evidence. Only 5 of the 682 news items included any discussion of the spectrum of scientific opinion regarding the claim, and only 24 items discussed the relative evidence for and against the claim. Of these, only one piece included an overall evaluation of which claim was most likely to be true given the available evidence.

Anecdotal reports suggest that a 'he said, she said' balancing strategy is also far more common than a weight of evidence approach in science coverage in other countries (e.g. Wilkins 1993; Dunwoody 1999; Wilson 2000; Starr 2002). However, Blum (2002) suggests that the more critical, analytical approach required by the weight of evidence strategy is becoming more common at least in the United States. No previous empirical studies have investigated the actual frequency of each approach.

## 8.3. Forces influencing verification and balance

In Chapter 2, I showed how various hierarchical forces influence the way that journalists select and shape media messages. The third goal of this study was to understand the various factors that affect verification and balance strategies for journalists reporting conflicting claims. Qualitative interviews and survey results were used to identify and discuss the various forces, although such data could not test the relative importance of different forces on the content patterns observed.

Furthermore, these data could only indicate what factors journalists think influence their behaviour, rather than looking for effects on actual scientific coverage. While I am assuming a relationship between their attitudes and behaviour in this regard, the two may not always correspond. In other words, there may be additional factors that limit journalists' verification or evaluation of scientific claims of which they are not cognisant or which they choose not to discuss. Similarly, the factors that they deem important might not always have a significant effect on final content. It was not possible to compare particular journalists' attributes to their stories in this study because the journalists that were surveyed and interviewed did not produce enough of the stories in the content analysis. Nonetheless, this analysis provides considerable insight into why journalists might act the way they do when reporting scientific claims.

### 8.3.1. Individual-level factors

#### *8.3.1.1. Scientific training*

Several authors have suggested that journalists with little or no scientific training might be less likely to recognize pseudo-science, hoaxes and frauds than journalists with a science background (Willis 1991; Fitzgerald 2002), and thus they may be less likely to seek out verification for such claims. Likewise, some authors have suggested that journalists use the balancing strategy because they do not have enough scientific knowledge to determine for themselves which of the claims is more likely to be true (Lambeth 1992; Nelkin 1995; Ericson 1998; Dunwoody 1999). Einsiedel (1992, p. 99) says, "Coupled with the constraints of daily news coverage, it becomes easier for journalists without some background in the science to surrender to scientific expertise."

However, the few studies to date that have looked empirically at whether formal training does improve science reporting (at least in the eyes of scientists) have largely failed to find any significant effects. For example, Weiss and Singer (1988) did not find any relationship between formal scientific training and the ability of journalists to produce stories that their sources judged as accurate and complete. Similarly, Wilson (2000; 2002) found that scientific training did not have a significant effect on journalists' knowledge of climate change.

In this study, the majority of surveyed journalists said that a lack of scientific knowledge limited their ability to use a weight of evidence approach and that scientific training for journalists would improve the quality of scientific reporting. However, scientific training did not have a significant effect on the number of sources that journalists said they typically use for science stories. This result has limited value given that it tested an attitudinal rather than a behavioural variable (i.e. how many sources journalists said they went to rather than how many they actually went to), but the interview data also suggest that scientific training is not as important to journalists as other factors. Only three of the 21 interviewed journalists in this study suggested that a lack of scientific knowledge affected their ability to evaluate scientific claims.

Moreover, many of the surveyed and interviewed journalists emphasized that science training could have disadvantages as well as benefits. For example, trained journalists might not be best at translating the technical aspects of science and they might not ask the questions that a non-scientific audience would want to know. Hansen (1994) found that for similar reasons, British journalists are also divided about the importance of scientific training.

*8.3.1.2. Experience reporting science*

A second individual-level factor that may help journalists to recognize when claims need further checking and to evaluate the evidence for conflicting truth-claims is a journalist's experience reporting science. Weiss and Singer (1988) found a weak relationship between the journalist's work experience and their ability to produce acceptable stories. In this study, experience reporting science did not have a significant effect on the number of sources that journalists said they typically use for science stories. Similarly, only three interviewed journalists said that a lack of experience made it difficult for them to judge scientific claims, although these journalists all suggested that experience reporting science was as important or more important than scientific training.

It is important to note, however, that although most of these journalists did not rate scientific training or experience reporting science as limiting factors, this study did not measure the effect of training or experience on actual coverage. It is therefore possible that journalists trained in science (or with years of experience reporting it) produce measurably different stories from those without training or experience. In particular, journalists with training might be more likely to hold similar values and ways of thinking to scientists and therefore be more likely to produce stories acceptable to them.

*8.3.1.3. Personal interest*

A third individual-level factor that may influence verification and balance practices is the journalists' personal interest in science. The survey results indicated that 39% of the New Zealand journalists surveyed were interested in doing more science reporting in the future. This suggests that despite a lack of experience and background in science and science reporting, journalists are not scared or intimidated by the complexity of science. Indeed, several reporters saw their role as interesting people in science rather than critically assessing it, partly because they share scientists' enthusiasm and trust in science as an important pursuit. Thus, other factors rather than a lack of personal interest may limit the amount of science that they can report.

In addition, personal interest may influence the types of science that receive media coverage, because in the absence of more information on the interests of their audience, journalists may assume that their interests are widely shared (Dunwoody 1993). The topics that the surveyed journalists identified as those that should receive the most media coverage corresponded well to the science topics that were actually covered most often in the content analysis. In particular, the emphasis on medical and environmental news may be reinforced by journalists' personal interest in the subjects.

*8.3.1.4. Professional roles*

A fourth individual-level factor that seems to have influenced the journalists' attitudes towards verification and balance is the way that they perceive their professional role. Johnstone et al. (1972) first suggested that some journalists see themselves as "neutrals" while others see themselves more as "participants". Journalists who see themselves as neutrals stress the dissemination function of the media, or their role in getting information out as quickly as possible and to the widest possible audience. Participant journalists on the other hand emphasize the interpretive function, or investigating official claims and analysing problems. Johnstone et al. (1972) suggested that more American journalists endorse the participant over the neutral model, and Weaver (1998) has suggested that the interpretive role is becoming more popular in the United States and probably in most other countries. However, these roles are not mutually exclusive and many journalists accept various practices from both roles (Weaver and Wilhoit 1991; Deuze 2002).

In this study, almost a third of the interviewed journalists said that they do not seek out multiple sources for many science stories because their job is to explain or translate science into a form that the layperson can understand (i.e. dissemination), not to offer a variety of opinions about a scientific claim (i.e. interpretation). In other words, they see their role as explanatory rather than analytical (Hotz 2002). Most of the journalists were not against interpretation as a general rule, but on the other hand, most also did not see it as their job to evaluate conflicting scientific truth-claims. This reinforces the notion that journalists perceive their role as a blend of dissemination and interpretation.

In this study, the way that journalists perceived their professional role as a journalist was closely related to the way that they defined objectivity. Journalists who tended to perceive themselves as passive transmitters, or 'neutrals' (i.e. 'Transmitters'; see section 8.3.2.1 below) also tended to relinquish responsibility for the validity of their sources' claims and instead focus on accurate reproduction (McCall 1988). 'Truth Seekers' on the other hand were more likely to stress the participant role and were thus more likely to verify and interpret claims, while 'Contextualisers' saw their role as a blend of dissemination and interpretation and were likely to verify claims but use a balancing approach to controversy.

Starck and Soloski (1977) also showed that the way that journalists define their job can affect media content. They found that journalism students who saw themselves as "neutral transmitters" (i.e. the 'Transmitters' type in this thesis; see section 8.3.2.1 below) wrote the least fair and comprehensive stories. In contrast, students who saw themselves as halfway between the neutral and participant roles ('Contextualisers' in this thesis) wrote the most objective and accurate stories.

### 8.3.2. Media routines

#### *8.3.2.1. Objectivity*

Continental European journalists believe their primary role is to interpret and evaluate (Donsbach 1995). They are far more passive than British and American journalists in working to get information for their stories. They rely more on news agency material, and there is no hierarchical structure so one person can write a news story and an editorial on the same subject. In contrast, American journalists have the strongest support for impartiality, objectivity and balance. Weaver and Wilhoit (1991) found that 69% of surveyed American journalists said that audiences were more interested in breaking news than in analysis.

This study suggests that New Zealand journalists seem to hold an intermediate conception of objectivity between the American and European definitions. Very few of the journalists in this study thought that objectivity was an achievable goal, although they did believe strongly that they should refrain from expressing their own opinions. Although this study dealt with only a small sample of journalists, the results suggest that at least some journalists reject traditional notions of objectivity.

The way that journalists defined objectivity, accuracy and balance affected how important they considered independent verification to be and also whether they were willing to evaluate scientific claims. The interviewed journalists were grouped into three types according to their definitions of these three concepts. First, 'Transmitters', or journalists who defined objectivity as an achievable goal that journalists attain by fairly balancing and accurately reproducing both sides of an issue, were less likely to emphasise the importance of independent verification than other journalists. They said that sources are responsible for the validity of their own claims, and they would probably be the most likely to use an "objectivity strategy" (i.e. accurately transmit and attribute claims no matter how likely they are to be true; sensu Dunwoody 1999).

Second, 'Truth Seekers' were journalists who claimed responsibility for their sources' claims and attempted to maximise factual truth, while minimizing personal opinions as much as possible. They saw objectivity as an unachievable yet desirable goal. Truth Seekers would probably be more likely than other journalists to independently verify the claims they report, and they would probably also be more likely to use the weight of evidence approach rather than an 'objectivity' or 'balancing' approach (Dunwoody 1999). However, many Truth Seekers were still wary of evaluating scientific claims themselves and might choose a balancing approach to controversy instead.

The third group, 'Contextualisers', said that objectivity is a meaningless concept because all journalists make subjective decisions. They instead preferred to talk about balance, accuracy and fairness. They thought that the audience should be able to make up their own minds, and so their goal was to include as much contextual information as possible to enable non-scientists to make informed decisions. However, they did not see their job as interpreting scientific evidence or deciding who is right in a scientific controversy. They would be more likely than Translators to independently verify claims, but they would probably present conflicting claims using a balancing strategy rather than a weight of evidence strategy.

*8.3.2.2. Trust in mainstream science and peer review*

Most of the interviewed journalists in this study said that they rely on mainstream scientists for most of their stories. Mainstream scientists at universities and major research institutions are easy to contact and they have obvious credentials and pre-established credibility (Dornan 1990). Institutionalised sources are also assumed to have access to more information (i.e. more "facts") and they tend to have had previous or on-going contact with the media (Tuchman 1978).

Hope (1996) suggests that the concentration of press ownership and deregulation may also have reinforced the dependence on primary news sources, because it is cheaper and faster to contact organizations with public information or public relations officers. Numerous studies have shown that in various countries, journalists tend to go to more visible scientists in the mainstream community than to those on the fringes (Shepherd 1979; Stocking 1985; Hansen 1994).

Mainstream organisations may also produce the majority of press releases, which journalists appear to rely on heavily for science coverage. For example, a 2002 study by the Royal Society of New Zealand (RSNZ) showed that about one-third of science and technology stories in the New Zealand media are based on press releases put out by the RSNZ (RSNZ unpubl. data). The other major scientific organisation in New Zealand, the New Zealand Association of Scientists (NZAS), also appears to receive frequent coverage of its press releases. Dr. Mike Berridge, the president of NZAS, was quoted during both the Lyprinol and Corngate incidents. The reliance on press releases may also favour lobby groups (e.g. Life Sciences Network, Greenpeace) that have active public relations departments generating press statements. All of these groups, therefore, end up speaking for scientists, whether or not their views are actually representative of most New Zealand scientists' opinions.

One result of this dependence on mainstream scientists seems to be that few maverick scientists receive coverage. More importantly, it also means that journalists may not feel the need to verify claims presented by mainstream scientists, which is reinforced by the perception that most mainstream scientists agree and that 'discoveries' in particular are simply 'facts' that do not require checking or balance. This perception can preserve the dominance of scientific authority, with little indication of the conflict often underlying most of science (Einsiedel 1992). For example, Priest and Gillespie (2000) found that American agricultural scientists have a range of views about appropriate agricultural biotechnology, which shows that even within a mainstream scientific group with special interests in the science, views are not necessarily homogenous and monolithic.

In addition to mainstream scientists, journalists also rely on peer reviewed journals for scientific information. Many journalists in this study said that information from these journals does not need to be verified, because it has already undergone an internal verification process within the scientific community. There was no significant difference in verification between stories about peer reviewed research versus those about unpublished research in the content analysis (see Chapter 5), but this was probably due to the large number of stories that did not specify whether the research had been peer reviewed. Other studies have also shown that journalists in other countries do not feel the need to verify claims that have already been peer reviewed. For example, Hansen (1994, p. 123) found that British journalists did not see the need to verify peer reviewed material and that such reporting is the only case "where journalists dispense with their normal routine and register of assessing credibility and validity." Similarly, Entwistle (1995) studied news articles based on the prestigious *British Medical Journal* and the *Lancet* and found that journalists said they would not routinely seek an opposing view. Journalists said that they relied on peer review and 'expert' opinions to guide them on the credibility of research, and they were concerned that opposing views might be motivated by rivalry and might weaken the story by questioning the claims.

### 8.3.3. Organisational constraints

The over-riding organisational factors that influence science reporting in New Zealand are limited time and the commercial imperative for news organisations to make a profit. The two are closely interlinked, because the drive to maximise profits and minimise costs means that news organisations have less money for in-depth coverage and in general, fewer staff are forced to cover more stories.

After 1984, the political economy of the New Zealand mass media was radically altered so that many news organisations were sold or commercialised. The resultant increase in commercialisation has meant less critical inquiry and investigative journalism in most areas (Booth 1992; Hope 1996). Saari et al (1998) also found that economic considerations were responsible for a low level of critical science coverage in Canada.

The result of increasing commercialisation is that news organisations attempt to gather news as cheaply as possible, which often means downloading stories from wire services, particularly for specialist subjects like science that take considerable resources to report. This is probably the main reason that 65% of science stories in the content analysis originated from overseas agencies.

In addition to commercial considerations, New Zealand journalists also have limited time to cover science because, as discussed above, most are general reporters who *at best* have to cover other rounds in addition to science (and at worse, simply cover science as an 'add-on' to their normal duties). And of course, all of this is in addition to the normal tight deadlines of news organisations that all journalists must work under.

In both their survey responses and interviews, journalists emphasised how much time constraints dictate the way that they report science. The journalists said that time often restricts the number of sources they are able to contact for a story, which is supported by overseas research that shows that journalists are more likely to produce single-source stories when they have strict deadlines (Dunwoody 1980; Fico 1984; Conrad 1999). In addition, journalists said that they often do not have time to critically assess the evidence for different truth-claims that might enable them to use a weight of evidence strategy. Saari (1998) also suggests that time constraints mean journalists conduct less background research and produce less critical reporting of scientific issues.

## 8.4. From mirror to sense-maker: A new role for science journalists

The Corngate case described in Chapter 3 illustrates some of the problems associated with a lack of verification and a 'he said, she said' balancing strategy for reporting conflicting truth-claims. The most important consequence of these practices is that journalists become passive transmitters of information rather than taking responsibility as active participants in the news process.

Although the journalists in this study were divided as to whether they saw themselves as 'neutrals' or 'active participants' in their stories, the overall net result of the current state of science reporting in New Zealand is that the media act largely as conduits through which scientific information flows. They merely transmit the messages that are given to them by their sources, rarely questioning these views or searching for other perspectives.

This philosophy is deeply rooted within certain norms of the journalistic profession. There is a widely held view that journalists do not make news, they report it; their role is to gather and transmit information in a neutral way. This passive model also once fitted nicely with communication discourse that suggested that the media are simply "channels" that select and transmit information "nonpurposively" (Lasswell 1948; Westley and MacLean 1957).

The problem with this media-as-channels approach is that it assumes that 'objectivity' is possible, and it fails to explain why media accounts of the same events can be so different (Shoemaker and Reese 1996). Journalists may emphasise certain people, places or points of view over others. They make decisions that influence what news is reported and how it is presented. They can create visual impressions and use rhetorical techniques that portray people and events in certain ways (Shoemaker and Reese 1996). Thus, newer models of mass communication emphasise that the media are active participants in the news process. Thus it has become increasingly acceptable for journalists in areas such as business, sport and politics to provide interpretation and commentary on the news they report.

Still, the role for journalists who report science is often been viewed as slightly different from other journalists. They are frequently viewed (and view themselves) as sympathetic translators who simply "report the facts" and mirror scientific controversy in simpler terms for the public (see Dornan 1990; Dearing 1995). As a result, critical debate, analysis and investigation of scientific issues appears to be rare.

Many sociologists and communication scholars have condemned the uncritical nature of most science reporting around the world (Friedman et al. 1986; Nelkin 1995). For example, Goodell (1987, p. 590) claims that "to a surprising extent, media coverage reflects the values of the scientific community, with relatively little of the compensation, scepticism, and investigation that customarily accompanies political reporting." Nelkin (1995, p. 164) likewise notes:

> While art, theatre, music and literature are routinely subjected to criticism, science and technology are almost always spared – until outrageous incidents occur. While political writers aim to analyse and criticise, science writers seek to elucidate and explain... Unaggressive in their reporting and reliant on official sources, science journalists present a narrow range of coverage. Many journalists are, in effect, retailing science and technology rather than investigating them, identifying with their sources rather than challenging them.

Nelkin and several other authors have suggested that the media (at least in the United States) started to become more critical of science during the 1990s (Wilkins and Patterson 1991; Nelkin 1995; Blum 2002). However, Dunwoody (1999) points out that no studies have systematically assessed the frequency of investigative reporting in science and that anecdotally, it still seems relatively rare overall. My own study suggests that at least in New Zealand, in-depth, analytical coverage is still very rare indeed (see Chapter 5).

Investigative reporting is important because media coverage can influence both public and government priorities. In particular, Protess et al (1991) found a direct effect from the media on politicians, often even before publication. For example, a news report on toxic waste disposal at the University of Chicago led to policy reforms including the building of a new disposal unit and new university policies.

Also, another effect of the lack of investigative reporting in science news is that journalists largely lose control of the news they produce and become conduits for sources who may be savvy at using the media to transmit their messages. Moreover, when contradictory claims are made, media routines and organizational structures usually mean that the elite positions are legitimised (Hall et al. 1978; Gans 1979; Shoemaker and Reese 1996). This has been termed an "information subsidy" effect, because sources with resources to staff public information or relations officers are more likely to appear in the news than those without these resources (Priest and Gillespie 2000).

This seems to be the case in New Zealand, where mainstream scientific organisations (e.g. Crown Research Institutes, universities, RSNZ, NZAS) are common sources for local science stories. Mainstream scientists and scientific organisations were the most common sources in the Corngate coverage (see Chapter 3) and interviewed journalists said that they relied mostly on mainstream organisations for scientific information (see Chapter 6). Moreover, these organisations actively reinforce the lack of critical science coverage here by trying to promote science rather than trying to create more analytical coverage and debate. For example, the Foundation for Research, Science and Technology (FRST), the major government funding body in New Zealand, recently advertised a new scholarship for a New Zealand journalist to attend an international conference on science writing in Britain. One of the goals of this award is to "encourage New Zealand journalists to produce the many successful/ positive stories available in the areas of research, science and technology."

Furthermore, when journalists fail to verify a scientific claim with a second source, scientists gain control because they are the only voice being transmitted. When conflicting truth-claims are presented, a scientist loses this power, but s/he can still control the message by managing the uncertainty that is inherent in the presentation of conflicting claims. By emphasising uncertainty, scientists may suggest that the evidence is too inconclusive to warrant policy changes (Zehr 1999).

The effect of all of this on news audiences is unclear. On one hand, by reporting science as a series of uncontested truth-claims, journalists distort the way that the scientific process actually works. Single-source stories may make some scientific claims appear more certain than they actually are, and if alternative views do eventually emerge, this can generate public scepticism (Check 1987). On the other hand, conflict has the effect of suggesting that scientists cannot reach a consensus, even in cases where most scientists agree (Nelkin 1995). This may increase the apparent uncertainty of science and make it difficult for audiences to decide which of the claims is likely to be true and whether the evidence warrants a change in personal behaviour or public policy.

This is important, because even if individual stories only present one side, audiences can receive a number of other perspectives in other places (Dunwoody 1999). In fact, so much information is now available to the public on the internet and in a range of diverse media that most people cannot wade through this information to make informed decisions on their own. Research suggests that conflicting information can cause confusion or cynicism rather than helping audiences cope with complex issues (Schommer 1990; Qian and Alvermann 1995; Rukavina and Daneman 1996).

Kovach and Rosentiel (2001) point out that the information 'overload' also means that journalists must spend a lot more time sifting through information (through the internet, wires and press releases). Moreover, efforts to encourage scientists to communicate more with the media have been so successful that now most scientists are aware of how important public outreach activities can be in raising public support and thus funding for research (Fitzpatrick 1999; British Select Committee on Science and Technology 2000). Consequently, journalists may now be flooded with press releases, media alerts and tip sheets from science organisations. The danger in all of this "outreach" is that journalists become "information gatekeepers" (Fitzpatrick 1999, p.12), spending their time sifting through information that they are given rather than actively gathering news.

However, at the same time, a passive role becomes harder to accept, because as Mindich (1998, p. 141) says, "With so much news and so many storytellers, there must be something more than passivity for responsible journalists to offer." Thus, Kovach and

Rosential (2001) believe that it may no longer be enough for journalists to simply point out the many different perspectives on an issue. They believe that the role of the media today is not to deliver the "truth" to a passive public but rather to give the public the information they need to make their own informed decisions:

> The new journalist is no longer deciding what the public should know. She is helping audiences make order out of it. This does not mean simply adding interpretation or analysis to news reporting. The first task of the new journalist/ sense maker, rather, is to verify what information is reliable and then to order it so people can grasp it efficiently. (Kovach and Rosenstiel 2001, p. 24)

This argument suggests that journalists need to move from being mirrors, simply reflecting what their scientific sources say, to actively help their audience make sense of scientific claims. However, this thesis suggests that this shift may be difficult for two key reasons. First, although the ideas of objectivity and verification were originally scientific concepts applied to journalism, today journalists and scientists (and media audiences) have very different ideas about what these concepts mean. These differences have created a tension between what scientists and media scholars want journalists to do and what journalists see as their job in reporting science. Scientists and many media scholars want journalists to assess the validity of scientific claims, while many journalists see their role as accurately conveying different perspectives and/or providing a context that enables their audience to make up their own minds.

Second, this thesis indicates that even if journalists can be convinced that it is their job to assess the validity of scientific claims, they still need ways to achieve such verification. Most journalists cannot empirically test scientific claims, nor do they have time to conduct exhaustive searches of the scientific literature. Thus, journalists need reliable shortcuts to judge scientific evidence within restrictive deadlines.

These two factors are discussed in further detail below, and some suggestions are given for how these difficulties might be overcome to improve science reporting in the New Zealand mass media in the future.

### 8.4.1. Objectivity: A scientific concept in the context of journalism

The concepts of objectivity and verification were originally scientific ideas that were applied to journalism in order to make journalism seem more professional (Nelkin 1995). Ironically, these concepts have taken on distinctly different meanings in the context of journalism, so that they are now a source of tension between scientists and journalists.

Longino (1990, p. 62) defines objectivity in science as "an accurate description of the facts of the natural world as they are" through the application of "non-arbitrary and non-subjective criteria." In other words, scientific objectivity relies on a rigorous, systematic method of testing information (i.e. the 'scientific method') through observation and experiment to assess the validity of a hypothesis (Griffin 1999; Kovach and Rosenstiel 2001).[11] Walter Lippmann's (1920) original application of the concept of objectivity to journalism in the 1920s was close to this scientific definition. Kovach and Rosentiel (2001, p. 72) say that at this stage, "Objectivity called for journalists to develop a consistent method– a transparent approach to evidence – precisely so that personal and cultural biases would not undermine the accuracy of their work."

However, almost as soon as objectivity was articulated as a professional norm in journalism, this original meaning was confused with the idea that the *journalist* (and not his or her method) could be objective (Hemanus 1976; Willis 1991; Donsbach and Klett 1993; Kovach and Rosenstiel 2001). Thus, today journalists define objectivity as a norm, or a "strategic ritual" as Tuchman (1972) has called it. This concept of journalistic objectivity encompasses a number of different elements (Boyer 1981; Westerstahl 1983), but most commonly, journalists refer to the aspects of neutrality (i.e. removing personal opinions, emotional detachment and the separation of fact and opinion), being fair to all sides and balancing conflicting views in an unbiased way (Boyer 1981; Donsbach and Klett 1993). In this study, journalists primarily emphasised

[11] In the philosophy of science literature, this definition of scientific objectivity is commonly called "intersubjectivity" to distinguish it from the notion of objectivity as a "true representation of 'reality'" (Donbach and Klett 1993, p.54).

the elements of removing personal opinions (especially Truth Seekers; see Chapter 6) and fairness and balance (Transmitters and Contextualisers).

Ironically, Nelkin (1995, p. 88) suggests that defined in this way, the modern journalistic concept of objectivity is the antithesis of scientific objectivity:

> This notion of objectivity is meaningless in the scientific community, where the values of 'fairness', 'balance' or 'equal time' are not relevant to the understanding of nature. On the contrary, scientific standards of objectivity require not balance but empirical verification of opposing hypotheses...Though journalists' norms of objectivity were initially modelled on the scientific method, their current implementation in reports of scientific disputes is very often a source of irritation to the scientists involved.

Furthermore, closely related to these differences in objectivity are differences in the way that journalists and scientists think about accuracy and verification. Dunwoody (1982, p.198) suggests that "both professions are wedded to the principle of accuracy" and yet they have very "different expectations that are grounded in the vastly different enterprises in which the parties are engaged." Scientists generally define accuracy as 'validity', or how well a hypothesis describes some natural or physical 'truth' or 'reality'. They verify the validity of a hypothesis through empirical testing, and thus the evidence that they use to judge a claim is restricted to empirically gathered, "statistically significant evidence" (Nelkin 1995, p.168).

Scientists tend use the same strict criteria to judge media accounts as they do their own research, so consequently, scientists who criticise media coverage of science tend to complain about "subjective inaccuracies" (Dunwoody 1982, p.196), or "errors in meaning" such as errors of omission, distortions in meaning, mis-emphasis and lack of completeness (e.g. see Tichenor et al. 1970; Tankard and Ryan 1974; Pulford 1976; Dunwoody and Scott 1982; Freimuth et al. 1984; Singer 1990). Such errors have to do with the 'truthfulness' or 'completeness' of media accounts; in other words, how well does the article convey the current scientific understanding?

Many journalism textbooks also emphasise the importance of seeking the "larger truths behind the facts" (e.g. Lambeth 1992, p 25), and in this study, some journalists (i.e. Truth Seekers and to a limited extent Contextualisers; see Chapter 6) accepted responsibility for the validity of their source's claims. However, in practice journalists tend to focus on "objective inaccuracies", or factual inaccuracies such as spelling mistakes, errors of fact and misquotes that can be "recognised as such by all parties" (Dunwoody 1982, p.196). Journalists can achieve factual accuracy by careful attention to the reproduction of what their sources tell them without concern for the validity of the statements they are transmitting. In this study, only two of the twenty-one interviewed journalists (called 'Transmitters') defined accuracy as 'accurate reproduction', and the remaining nineteen journalists all accepted at least some responsibility for the validity of the claims they report. If the principle of accuracy as validity is so widely accepted then, why are practices that establish the validity of claims - namely independent verification and the weight of evidence approach – so uncommon in science news?

### 8.4.2. Trade-offs between balance and accuracy

The shortage of independent verification and the weight of evidence approach in science reporting can be understood further by examining the relationship between accuracy and balance. According to Westerstahl's (1983) model of objectivity, which was introduced in Chapter 3, accuracy and balance represent the two components of objectivity: 'factuality' and 'impartiality', respectively. Most journalists face a tension between these two dimensions, "between impartially reporting contradictory truth-claims by high-status sources, on the one hand, and independently determining the validity of such truth-claims, on the other" (Hackett 1984, p. 231).

In this study, the more closely journalists defined objectivity to the notion of balance, the more likely they were to reject responsibility for the validity of the claims they report. Journalists that were categorised as 'Transmitters' defined objectivity primarily in terms of balance, and they defined accuracy as accurate reproduction, relinquishing responsibility for their sources' claims. In contrast, Truth Seekers defined objectivity as the removal of personal opinions, they tended to recognise the potential problems in balance, and they tended to take greater responsibility for the validity of their sources' claims. The third group, Contextualisers, were intermediate between these two views. They rejected the concept of objectivity outright, recognised balance as a 'double-edged sword' and accepted limited responsibility for the validity of some claims, although they thought it should ultimately be left to the audience to decide.

When journalists are forced to decide whether to maximise their impartiality through balance or their factuality by verifying the validity of their sources' claims, there are at least three reasons that they might prioritise balance above accuracy defined as validity. First, scientific claims that turn out to be false can still have great news value, and as Jerry Bishop, a science writer at *The Wall Street Journal* put it, the media "don't judge scientific validity; we make news judgements" (Gorchow 1990, p. 2). Second, it is easier for journalists to meet the requirements of balance than it is for them to establish validity, particularly within the tight time constraints of news organisations (Dunwoody 1999). Unlike scientists, journalists cannot empirically test competing theories, and they must therefore rely on other sources to verify the claims for them (Tuchman 1972; Rowan 1989).

Third, and perhaps most importantly, failure to meet balance and fairness guidelines is more risky for journalists than failure to verify the validity of claims that they report. If journalists report a scientific claim unfavourably, they risk alienating scientists that might have been future sources (Dunwoody 1999). Furthermore, media regulations and regulatory bodies tend to emphasise balance and fairness over journalists' responsibility to ensure the validity of claims they report. Journalists generally cannot be held legally accountable for reporting inaccurate information if it is attributed to named sources (Tuchman 1978), but they could face a defamation suit or be punished by a regulatory body for being unfair or biased in their reporting.

This prioritisation of balance over accuracy is exemplified in the response of the New Zealand Press Council to a recent complaint against an article on immunisation. The complaint was directed at two paragraphs of an article that appeared in *The Press* on September 15, 2001. One of these paragraphs suggested that whooping cough vaccinations in Sweden were stopped in 1979 and that "the country has not gone back to immunising because of the risk of side-effects from the vaccine." The complainant pointed out that this statement was wrong and that vaccinations were in fact restarted in Sweden when a large number of cases of whooping cough began to occur.

The editor of *The Press* responded by saying that the article was an account of the immunisation debate rather than an investigation into the validity of the different points its sources made, and that this was a common and acceptable type of journalism (Press body rejects complaint 2002). He strongly defended the article's overall balance and suggested that although the article would have been better if the claim had been checked, the complainant had attached "undue weight" to particular details. The Press Council agreed with the editor, finding that the article was "well-constructed" and "well-balanced" and that the error would not have had a drastic effect on the audience (Press body rejects complaint 2002).

### 8.4.3. Ways to encourage verification and evaluation

For all of the above reasons, balance is easier, more newsworthy and less risky for journalists than assessing validity through a weight of evidence approach. Thus, there are three general ways that independent verification and a weight of evidence approach might be encouraged. First, journalists could be convinced that accuracy is more appealing to audiences than balance (i.e. more newsworthy). However, this study shows that this is likely to be difficult, because the focus group study described in Chapter 7 suggests that audiences may not want news that emphasises validity assessments and the weight of evidence over balance and impartiality. The students in this study, even though they were relatively educated compared to the general population, preferred news stories that were clear, interesting and easy to understand, over stories that were more informative but less readable. Moreover, they valued a balanced, unbiased approach and wanted to be able to make up their own minds, although some thought this could be achieved using a weight of evidence approach.

Second, independent verification and a weight of evidence approach could be encouraged by giving journalists incentives to strive for accuracy (i.e. validity), especially when it conflicts with their desire to remain balanced and fair. In particular, regulatory bodies could be encouraged to alter regulations such as the Broadcasting Act to emphasise the journalist's responsibility for the validity of the information they report as much as they emphasise balance.

One such set of guidelines has already been produced in Britain by the British Social Issues Research Centre (SIRC) in partnership with the Royal Society and the Royal Institution of Great Britain. These guidelines were designed to encourage journalists to strive for accuracy not only "in this sense that details of studies and specific findings are reported faithfully" but also in terms of minimising misrepresentation and distortion that can arise "in the interpretation of the findings, in generalisations made from limited data, selective coverage of available evidence, and the failure to refer to contradictory findings" (Social Issues Research Centre et al. 2001, p.5). The guidelines suggest ways that journalists can improve accuracy in this broader sense, by analysing: the credibility of the sources, the methods used (e.g. sample size, control groups, duration of the study), how the findings mesh with previous research, and the limitations and significance of the findings. The British Press Complaints Commission has formally endorsed the SIRC guidelines.

The third way that verification and the weight of evidence approach might be encouraged is by enabling journalists to achieve accuracy more easily than balance. This option partly involves an increase in resources for science reporting so that journalists have the time needed to check the validity of the information they report. Verification and the weight of evidence approach take more time than presenting one source, or even balancing two perspectives, and thus journalists may need longer deadlines. In addition, journalists need effective ways to judge scientific evidence, which will be discussed further in the next section.

### 8.4.4. New modes of journalistic verification

Even if journalists can be convinced that it is their job to assess the validity of scientific claims, they still need ways to achieve such verification. In other words, as Durham (1998, p. 134) says, "The trick for the standpoint reporter is to be able to decide on the validity of a knowledge claim regardless of who speaks it, while understanding that who speaks does have a bearing on what is made known."

Wilkie (1996, p. 1308) points out that journalists do not suffer from a shortage of scientific information or sources, but rather their primary difficulty is "to filter the reliable from the dubious". Just like objectivity, accuracy and verification are scientific terms that have taken on new meanings in the context of journalism. To scientists, accuracy means verifying the validity of a scientific claim and verification is achieved by empirically testing the hypothesis. In contrast, accuracy to some journalists is closer to what scientists would call 'reliability', that is the accurate representation of what their sources have told them (McCall 1988). This is because journalists cannot empirically test most scientific claims. Thus, many journalists 'verify' (i.e. certify) scientific claims either by ensuring that their sources are credible, or by relying on scientific peer review to weed out unsubstantiated claims for them.

Both of these surrogates are problematic given the changing nature of science and communication technology. First, although it is important for journalists to ensure their sources are reliable and well-qualified to speak on the issue at hand (Dunwoody 1999), it is increasingly difficult for journalists to identify the credibility of their sources. Griffin (1999, p. 244) says, "For journalists and the public alike, landmarks that used to identify trustworthy sources and valid information are disappearing." The internet and other communication technologies have made it possible for almost anyone to broadcast an opinion and claim to be an 'expert'. Moreover, widespread commercialisation of scientific research has made it difficult for journalists to find scientists without a financial stake in the research, particularly in the medical field (Dean 2002; O'Hare 2003). For example, a recent *British Medical Journal* study found that studies sponsored by pharmaceutical companies are four times more likely to produce results that favour the company than studies sponsored by other sources (O'Hare 2003). Hotz (2002, p. 6) suggests that "the scientists who might be expected to provide the clearest guidance in such debates are increasingly hobbled by commercial secrecy, financial conflicts or professional self-interest."

Similar problems face journalists who rely solely on the peer review process as a filter to judge the credibility of scientific claims. Entwistle (1995, p. 922) points out that "peer review is not intended to function as a censor for the public interest," and its ability to do so seems to have diminished given recent changes within science.

Academic institutions now have a smaller role in producing science, whereas the number of authors who work for commercial companies and the proportion of scientific funding that is corporate has increased (Wilkie 1996). Also, issues of fraudulent data, plagiarism, dual publication and honorary authorship have led to some dissatisfaction with the peer review process from both within and outside of the scientific community (Griffin 1999). Jefferson et al (2002) point out that although peer review is widely used, it is largely untested and its effects are uncertain. For all of these reasons, peer review may provide an indicator of credibility, but it should not always be deemed a "golden seal of approval" (Does sex really make you run faster? 2000, p. 8).[12]

If source credibility and peer review are not sufficient ways to verify scientific claims then what other tools could journalists use to determine their validity? One option that has been suggested is for journalists to rely on the 'scientific consensus' whenever possible. Wilson (2002) defines consensus as the next level of agreement below scientific certainty, where there is large agreement among scientists about the findings but still some unknowns.

Rowan (1999) believes that journalists are more likely to achieve balance, accuracy and objectivity in covering science news if they let audiences know how widely key claims are supported by most scientists. This does not necessarily mean that minority views are necessarily wrong or should be omitted entirely, but it does suggest that journalists need to find out which arguments are mainstream and which are outliers and to clearly state which views are in the minority (Boffey et al. 1999). Perlman (1974) suggests that every scientific discipline should develop their own organisation to provide a guide to the mainstream consensus view when relevant issues arise.

Although some communication authors suggest that journalists should rely on the scientific consensus as a guide, it is interesting that most of the surveyed journalists in

[12] Journalists may often treat conference talks as if they were peer reviewed, but usually only the abstracts (if anything) are actually subject to the peer review process. Often scientists present their newest and most preliminary data at conferences before they publish the work in a peer reviewed journal, and therefore, journalists need to be particularly cautious of over-stating claims from conference papers (Blum and Knudson 1997).

this study said that they did not have a responsibility to find out the scientific consensus. There are several potential problems with a reliance on the consensus. First, to my knowledge no studies to date have shown that audiences pay attention to the consensus, and in fact there is some evidence to suggest that audiences may often give more weight to minority views (Dearing 1995).

Second, relying on a consensus view gives control to institutional sources that may not always be right but have more power in society than other sources. This may make it difficult for less powerful sources to challenge the scientific status quo. Also, as discussed above, scientists and scientific organisations increasingly have vested financial and commercial interests in research, and it is becoming more difficult to obtain truly independent scientific advice. For these reasons, Hargreaves and Ferguson (2000) suggest that relying on the majority consensus:

> ...not only sounds unrealistic in the fast-moving news game, it is also potentially positively dangerous. The point of public debate in democracies is that minority views achieve exposure, not only because they sometimes turn out to be right but because in resisting them, those with the majority on their side can work towards achieving a wider, voluntary consensus.

Another alternative that could enable journalists to judge scientific claims more effectively is to give the journalists cognitive tools that will help them make evaluations of the scientific evidence, rather than encouraging them to assess some surrogate (e.g. source credibility, scientific consensus). Ehrlich (2001) has pointed out that the criteria for judging scientific claims can be related not only to the proposer of the idea (e.g. their qualifications or motivations), but also to the manner in which the idea is presented (e.g. the use of statistics and references) as well as to the idea itself (e.g. its falsifiability).

Ehrlich and a number of other authors (e.g. Griffin 1999; Collins et al. 2001; Ryder 2001) believe that it is possible to give non-scientists cognitive tools that will help them judge the validity of scientific ideas without training in the actual science content. After all, journalists are not the only non-scientists who must make important decisions about scientific evidence. Government officials must weigh scientific evidence in making public policy decisions and judges and juries can even exclude expert scientific testimony if "there is simply too great an analytical gap between the data and the opinion offered" (Biskupic 1997, p. A2). A United States Supreme Court decision in 1997 found that judges must examine not only the conclusions of a scientific expert, but also their methodology. For example, they found that it was appropriate for a judge to bar expert testimony based on studies of mice as evidence for the claim that a man got lung cancer after handling PCBs (Biskupic 1997).

Several authors have written about what people need to know about how science functions, or what Collins et al. (2001) call "ideas-about-science". These authors argue that it is as important, or more important, for people to learn about the epistemology and sociology of science as it is for them to learn about the concepts, theories and facts of science. The former may do more to enable individuals to engage with scientific issues in their daily lives. For example, to make decisions about new scientific discoveries and applications, people may require the ability to distinguish sound from unsound arguments, and to differentiate evidence from hypotheses (Collins et al. 2001). It may also help non-scientists to understand the process of science, especially that science works through the continual testing of new ideas and the gradual building of theory (Ehrlich 2001; Ryder 2001).

Below is a list of some of the questions that various authors (see Griffin 1999; Does sex really make you run faster? 2000; Ehrlich 2001) have suggested that non-scientists might ask in order to evaluate scientific claims:

1. Is the idea "frontier" science or "textbook" science? In other words are the ideas new and preliminary and thus do they require further testing? Any areas of uncertainty should be explicitly noted.
2. Does the claim differ markedly from previous studies? Science works by the gradual accumulation of knowledge so claims should build on (and make reference to) previous research on the topic.
3. Does the claim fit with what we know about the world? As Carl Sagan said, extraordinary claims require extraordinary evidence to support them. The more outrageous the claim, the more evidence must be produced to prove it is valid.
4. How large was the sample size for the study? What was the duration of the study? Was there a control group? In general, studies that have a larger sample size, a longer duration and a control group are more robust.

5. Is the claim falsifiable? In other words, can the claim be tested and proven wrong? All scientific claims must be testable.
6. Are statistics used honestly and accurately? Some basic knowledge of statistics can be useful for interpreting scientific claims, and numerous texts are available to assist non-scientists in doing so (see e.g. Cohn 1989; Paulos 1995; Utts 1996).
7. If the claim suggests a risk, how great is the risk compared to other risks that we are familiar with? For example, if a study suggests that cell phones may cause cancer, how big is that risk compared to the risks associated with smoking?
8. How significant were the results of the study? How sure can we be that the results are reliable and could be repeated in another study?
9. Does the study confuse correlation with causation? For example, high cell phone use and cancer may be correlated, or associated with each other. However, extra evidence is needed to show that using a cell phone actually causes cancer.
10. For health and medical claims, were the trails conducted on humans, animals or in a petri dish? Studies based on in vitro tests or animals must be generalised to humans with caution.
11. Also for health and medical claims, are the claims based on double-blind trials, where neither the subjects nor the administrators of the trial knew who was part of the control group or the treatment group?
12. Do the claims rely on anecdotal evidence (e.g. one cell phone user who was diagnosed with a brain tumour)? If so, is this anecdotal evidence representative of a trend backed by experimental evidence?
13. Are there other confounding factors that might explain the results? For example, do cell phone users tend to have different lifestyles, which might also contribute to their cancer rates?
14. Do the claimants have a vested interest in people believing their claim? For example, do the scientists have commercial ties that mean they will benefit from the promotion of a certain product?
15. Who has funded the research? Does the funding agency have a vested interest in proving something? For example, if a drug company if funding a trial involving one of their products, they may have a vested interest in showing that the drug is effective.

## 8.5. Directions for further research

Given that science communication is such a new and unexplored field in New Zealand, the options for further research are nearly boundless. However, this research suggests three areas might be particularly informative to follow-up. First, given that so much science news in New Zealand is imported from overseas wire services and news organisations, it would be interesting to focus on the role of editors in science news and to describe this process of adapting science stories off the wires in more detail. How do New Zealand editors view science and how do they view objectivity? How similar are their values to journalists' values?

A second interesting follow-up study would be to focus on an empirical comparison of the individual attributes of journalists and the actual coverage they produce. It was not possible to conduct such a comparison in this study because most of the stories in the content analysis were not written by the journalists who were surveyed and interviewed (and who also spend the most time reporting science). Such a comparison could only be conducted for New Zealand science coverage by using a much longer time-frame (say 3-5 years) and following key journalists' stories through time. This type of study would enable researchers to look more closely at whether scientific training or experience reporting science actually make a difference in a journalist's coverage of science. It would also permit an empirical test of the relative importance of factors at different hierarchical levels, as done for political coverage by Shoemaker et al (2001).

A third and final avenue for further research would be to look in more detail at the ways that journalists currently judge scientific evidence, and to search for cognitive tools that might assist journalists in assessing claims more effectively. Several studies suggest ways that journalists (or the public) might think systematically and critically about scientific evidence (e.g. Griffin 1999; Ehrlich 2001), but more could be done to empirically test the utility of such techniques for practicing journalists.

## 8.6. Conclusions

With a population of just four million people and correspondingly small news organisations that are commercially driven, New Zealand will probably never have abundant resources for science reporting, nor more than a handful of science specialists. Klaidman (1990, p. 121) has suggested that given the constraints on small news organizations, "little can be done to improve coverage where demand for quality is low, resources are limited and the most talented young reporters stay on the staff only a short time." Does this mean that science reporting in New Zealand can never improve?

This study offers some encouragement that the answer is 'no' and that there is considerable hope for improvement in New Zealand science coverage. First, this study shows that there is a group of journalists here who currently spend little time on science but who have a strong interest in and desire to report science. Second, it is also clear from this study that resources are only one of a number of factors that influence science coverage. The scientific training of individual journalists has already received some attention, but the normative dimensions of journalism seem to be equally important. There is much to be gained from a reassessment of how journalists see their role in science and how they perceive journalistic objectivity, accuracy and balance.

# ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisors, Jim Tully (Mass Communication and Journalism) and Dave Kelly (Biology) for enabling me to create such an interdisciplinary research project. This thesis could not have been completed without their expertise, encouragement and support. Also huge thanks to the staff of both the Mass Communication and Biology Departments for jobs too numerous to name.

I received funding for this research from the Royal Society of New Zealand and financial support from the Fulbright Foundation and a University of Canterbury doctoral scholarship. The Ministry of Research, Science and Technology (MORST) also funded my attendance at an international conference. I would like to thank these organisations, and in particular Richard Meylan, Alan Hull and Piet de Jong at MORST, Glenda Lewis and Tasha Black at RSNZ, and Jennifer Gill and Laurie Wright at Fulbright for their generosity, interest and logistical support throughout this project.

Many journalists gave of their already limited time to help with this project and I would like to thank all of those involved. In particular, I would like to thank the journalists who agreed to be interviewed, many of whom contacted me later with other comments and advice. Also thanks to the students who participated in the focus group study.

Numerous other people assisted in the development and analysis stages of this research. I would especially like to thank Ann Winstanley, Jeff Foote, Maria Jellie and Alistair Sheat at Environmental Science and Research (ESR). Rob Logan (University of Missouri) and Sharon Dunwoody (University of Wisconsin) provided valuable advice on my thesis proposal, and Richard Holliman (Open University) commented on the data in several chapters.

Many thanks to Steven Price, Nicky Hager, Howard Bezar, Russell Brown and Rob Lake for their assistance with the Corngate case study. Allan Bell and Debbie Jeffery also took considerable time and effort to provide me with data for several other case studies. Although these case studies could not be examined in detail here, they greatly informed this thesis and will provide excellent material for future work. Also thanks to Keith Lyons, Barbara Fountain and Wanda Vivequin for comments on a draft of the survey.

Finally, I don't know why family and friends are always last to be acknowledged, because I for one could never have finished this thesis without them. Massive thanks to Frase especially for all the vital study breaks and adventures that pulled me through. For support from afar, thanks to Lad and Vicki. For laughs, hugs, encouragement, motivation and support, thanks to Jen, Amber, Hazel, Meredith, Jo, John, Catriona, Julia, Jenny and Malcolm.

# REFERENCES CITED


Abbott, E. A. and L. T. Brassfield. (1989). Comparing decisions on releases by TV and newspaper gatekeepers. *Journalism Quarterly* **66**: 853-856.

Abel, S. (1997). *Shaping the News: Waitangi Day on Television.* Auckland: Auckland University Press.

Angell, M. (1996). *Science on trial: the clash of medical evidence.* New York: W.W. Norton.

Ansley, B. (2003). Occupied territory. *New Zealand Listener* **189** (3274) (8 February): 34.

Anton, T. and R. McCourt. (1995). *The New Science Journalists.* New York: Ballantine Books.

Atkinson, J. (1994). The state, the media and thin democracy, in *Leap into the Dark: The Changing Role of the State in New Zealand Since 1984*, edited by A. Sharp. Auckland: Auckland University Press. pp. 146-177.

Atkinson, J. (2003). Corngate, the worm and the weakest link: New Zealand's 2002 television election campaign coverage. Paper presented at New Zealand Political Studies Association Conference, Auckland, NZ, April 12-13.

Atwater, T., M. B. Salwen and R. B. Anderson. (1985). Media agenda-setting with environmental issues. *Journalism Quarterly* **62**: 393-397.

Bagdikian, B. H. (1973). Shaping media content: Professional personnel and organisational structure. *Public Opinion Quarterly* **37**: 569-579.

Bass, A. Z. (1969). Refining the "gatekeeper" concept: A UN radio case study. *Journalism Quarterly* **46**: 69-72.

Bauer, H. H. (1994). *Scientific Literacy and the Myth of the Scientific Method.* Chicago: University of Illinois Press.

Becker, L. B., J. W. Fruit and S. L. Caudill. (1987). *The Training and Hiring of Journalists.* Norwood, NJ: Ablex.

Bell, A. (1994a). Climate of opinion: public and media discourse on the global environment. *Discourse and Society* **5**(1): 33-64.

Bell, A. (1994b). Media (mis)communication on the science of climate change. *Public Understanding of Science* **3**: 259-275.

Bell, A. (1995). 'An endangered species': Local programming in the New Zealand television market. *Media, Culture and Society* **17**: 181-200.

Bennett, W. L. (1988). *News: The Politics of Illusion.* White Plains, NY: Longman.

Berelson, B. (1952). *Content Analysis in Communication Research.* New York: Hafner Press.

Berger, A. A. (2000). *Media and Communication Research Methods: An Introduction to Qualitative and Quantitative Approaches.* Thousand Oaks, CA: Sage.

Biskupic, J. (1997). Trial judges have wide discretion on scientific testimony, Court says. *The Washington Post*, Washington D.C., 16 December 1997. pp. A2.

Blakeslee, S. (1986). *Human Heart Replacement: A New Challenge for Physicians and Reporters.* Los Angeles: Foundation for American Communications.

Blum, D. (2002). Investigating science. *Nieman Reports* **56**(3): 13-15.

Blum, D. and M. Knudson. (1997). *A Field Guide for Science Writers.* New York: Oxford University Press.

Boffey, P. M., J. E. Rodgers and S. H. Schneider. (1999). Interpreting uncertainty: A panel discussion, in *Communicating Uncertainty: Media Coverage of New and*

*Controversial Science*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum. pp. 81-91.

Booth, P. (1992). Investigative journalism: The New Zealand experience, in *Whose News?*, edited by M. Comrie and J. McGregor. Palmerston North: Dunmore Press. pp. 161-169.

Borman, S. C. (1978). Communication accuracy in magazine science reporting. *Journalism Quarterly* **55**: 345-346.

Boyer, J. H. (1981). How editors view objectivity. *Journalism Quarterly* **58**: 24-28.

Breed, W. (1955). Social control in the newsroom: A functional analysis. *Social Forces* **33**: 179-.

British Select Committee on Science and Technology. (2000). British Select Committee on Science and Technology Third Report. Unpublished report for British Parliament. London.

Broberg, K. (1973). Scientists' stopping behavior as indicator of writer's skill. *Journalism Quarterly* **50**: 763-767.

Burkett, D. W. (1973). *Writing Science News for the Mass Media.* Houston, Texas: Gulf Publishing Company.

Burnham, J. (1991). Of science and superstition: The media and biopolitics, in *Media and the Environment*, edited by C. L. LaMay and E. E. Dennis. Washington D.C.: Island Press. pp. 29-41.

Burnham, J. C. (1987). *How Superstition Won and Science Lost: Popularizing Science and Health in the United States.* New Brunswick, New Jersey: Rutgers University Press.

Carey, J. (1989). *Communication and Culture.* Boston: Unwin Hyman.

Case, T. (1993). Newspapers as community boosters. *Editor and Publisher* (9 October): 32-33, 49.

Caudill, E. (1987). A content analysis of press views of Darwin's evolution theory, 1860-1925. *Journalism Quarterly* **64**: 782-786.

Caudill, E. (1989). The roots of bias: An empiricist press and coverage of the Scopes trial. *Journalism Monographs* **114**.

Chalaby, J. K. (1998). *The Invention of Journalism*. New York: St. Martin's Press.

Charmaz, K. (2002). Qualitative interviewing and grounded theory analysis, in *Handbook of Interview Research*, edited by J. F. Gubrium and J. A. Holstein. Thousand Oaks, CA: Sage. pp. 675-694.

Check, W. A. (1987). Beyond the political model of reporting: nonspecific symptoms in media communication about AIDS. *Reviews of Infectious Diseases* **9**(5): 987-1000.

Clayman, S. E. and A. Reisner. (1998). Gatekeeping in action: editorial conferences and assessments of newsworthiness. *American Sociological Review* **63**: 178-199.

Clayton, A., M. Hancock-Beaulieu and J. Meadows. (1993). Change and continuity in the reporting of science and technology: a study of *The Times* and the *Guardian*. *Public Understanding of Science* **2**: 225-234.

Clifton, J. (2003). Charter's orders. *New Zealand Listener* **189** (3278) (8 March): 20-22.

Coddington, D. (1999). Shelling out for a cancer cure. *North and South* **163** (October): 34-44.

Cohn, V. (1989). *News and Numbers*. Ames, IA: Iowa State University Press.

Cole, B. J. (1975). Trends in science and conflict coverage in four metropolitan newspapers. *Journalism Quarterly* **52**: 465-471.

Collins, S., J. Osborne, M. Ratcliffe, R. Millar and R. Duschl. (2001). What 'ideas-about-science' should be taught in school science? A Delphi study of the expert community. Paper presented at American Educational Research Association Conference, Seattle, WA, 10-14 April 2001.

Combs, B. and P. Slovic. (1979). Newspaper coverage of causes of death. *Journalism Quarterly* **56**(4): 837-843, 849.

Comrie, M. (1999). Television news and broadcast deregulation in New Zealand. *Journal of Communication* **49**(2): 42-54.

Comrie, M. (2000). Mussel-bound: the New Zealand media and the launch of Lyprinol. *International Communication Bulletin* **35**(3): 12-16.

Conrad, P. (1999). Use of expertise: sources, quotes and voice in the reporting of genetics in the news. *Public Understanding of Science* **8**: 285-302.

Corbett, J., J. Durfee, R. Gunn and K. M. Krakowjak. (2002). Testing public (un)certainty of science: media representations of global warming. Paper presented at Public Communication of Science and Technology 7 Conference, Capetown, South Africa, 5-7 December 2002.

Corner, J. and K. Richardson. (1993). Environmental communication and the contingency of meaning: a research note, in *The Mass Media and Environmental Issues*, edited by A. Hansen. Leicester: Leicester University Press. pp. 222-233.

Crane, V. (1992). Listening to the audience: Producer-audience communication, in *When Science Meets the Public*, edited by B. V. Lewenstein. Washington, D.C.: American Association for the Advancement of Science. pp. 21-32.

Day, P. (1990). *The Making of the New Zealand Press.* Wellington: Victoria University Press.

Deacon, D., M. Pickering, P. Golding and G. Murdock. (1999). *Researching Communications: A Practical Guide to Methods in Media and Cultural Analysis*. London: Arnold.

Dean, C. (2002). New complications in reporting on science. *Nieman Reports* **56**(3): 25.

Dearing, J. W. (1995). Newspaper coverage of maverick science: creating controversy through balance. *Public Understanding of Science* **4**: 341-361.

Dearing, J. W. and E. M. Rogers. (1996). *Agenda-setting*. Thousand Oaks, CA: Sage Publishing.

Demers, D. P. (1991). Corporate structure and emphasis on profits and product quality at U.S. daily newspapers. *Journalism Quarterly* **68**: 15-26.

Dennis, E. E. and J. McCartney. (1979). Science journalists on metropolitan dailies. *Journal of Environmental Education* **10**: 9-15.

Detjen, J. (1995). The media's role in science education. *BioScience* **Supplement**: S58-S63.

Deuze, M. (2002). National news cultures: A comparison of Dutch, German, British, Australian and U.S. journalists. *Journalism and Mass Communication Quarterly* **79**(1): 134-149.

Does sex really make you run faster? (2000). *Consumer* **393** (June): 6-9.

Donohue, G., C. N. Olien and P. J. Tichenor. (1985). Reporting conflict by pluralism, newspaper type and ownership. *Journalism Quarterly* **62**: 489-499, 507.

Donsbach, W. (1995). Lapdogs, watchdogs and junkyard dogs. *Media Studies Journal* **9**: 17-30.

Donsbach, W. and B. Klett. (1993). Subjective objectivity: How journalists in four countries define a key term of their profession. *Gazette* **51**: 53-83.

Dornan, C. (1990). Some problems in conceptualizing the issue of "science and the media". *Critical Studies in Mass Communication* 7: 48-71.

Dunwoody, S. (1980). The science writing inner club: a communication link between science and the lay public. *Science, Technology & Human Values* 5: 14-22.

Dunwoody, S. (1982). A question of accuracy. *IEEE Transactions on Professional Communication* PC-25: 196-199.

Dunwoody, S. (1993). *Reconstructing Science for Public Consumption: Journalism as Science Education*. Geelong: Deakin University Press.

Dunwoody, S. (1999). Scientists, journalists, and the meaning of uncertainty, in *Communicating Uncertainty*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum Associates. pp. 59-79.

Dunwoody, S. (2001). Does the storyteller matter? Paper presented at American Association for the Advancement of Science annual meeting, San Francisco.

Dunwoody, S. and R. J. Griffin. (1993). Journalistic strategies for reporting long-term environmental issues: A case study of three Superfund sites, in *The Mass Media and Environmental Issues*, edited by A. Hansen. Leicester: Leicester University Press. pp. 22-50.

Dunwoody, S., D. Harp, R. Barth and E. Crane. (1999). Directory of science communication courses and programs in the United States. University of Wisconsin-Madison, August 1999. [online] http://www.journalism.wisc.edu/dsc/staff.html. (Accessed on 10 June 2003).

Dunwoody, S. and H. P. Peters. (1992). Mass media coverage of technology and environmental risks: A survey of research in the U.S. and Germany. *Public Understanding of Science* 1: 199-230.

Dunwoody, S. and M. Ryan. (1983). Public information persons as mediators between scientists and journalists. *Journalism Quarterly* **60**: 647-656.

Dunwoody, S. and M. Ryan. (1985). Scientific barriers to the popularisation of science in the mass media. *Journal of Communication* **35**(1): 26-42.

Dunwoody, S. and M. Ryan. (1987). The credible scientific source. *Journalism Quarterly* **64**: 21-27.

Dunwoody, S. and B. T. Scott. (1982). Scientists as mass media sources. *Journalism Quarterly* **59**: 52-59.

Dunwoody, S. and E. Wartella. (1979). A survey of the structure of science and environmental writing courses. *Journal of Environmental Education* **10**: 29-36.

Durant, J. (1993). What is scientific literacy?, in *Science and Culture in Europe*, edited by J. Durant and J. Gregory. London: Science Museum. pp. 129-138.

Durant, J. and G. A. Evans. (1989). Understanding of science in Britain and the U.S.A., in *British Social Attitudes: Special International Report*, edited by R. Jowell, S. Witherspoon and L. Brook. Aldershot, UK: Gower.

Durant, J. R., G. A. Evans and G. P. Thomas. (1989). The public understanding of science. *Nature* **340**: 11-14.

Durham, M. G. (1998). On the relevance of standpoint epistemology to the practice of journalism: The case for "strong objectivity". *Communication Theory* **8**(2): 117-140.

Efron, E. (1985). *The Apocalyptics: How Environmental Politics Controls What We Know About Cancer*. New York: Simon and Schuster.

Ehrlich, R. (2001). *Nine Crazy Ideas in Science: A Few Might Even be True*. Princeton, NJ: Princeton University Press.

Eide, M. and R. Ottosen. (1994). 'Science journalism' without the science journalists: notes on a Norwegian media paradox. *Public Understanding of Science* **3**: 425-434.

Einsiedel, E. and E. Coughlan. (1993). The Canadian press and the environment: Reconstructing a social reality, in *The Mass Media and Environmental Issues*, edited by A. Hansen. Leicester: Leicester University Press. pp. 134-149.

Einsiedel, E. F. (1992). Framing science and technology in the Canadian press. *Public Understanding of Science* **1**: 89-101.

Emery, M. and E. Emery. (1996). *The Press and America: An Interpretive History of the Mass Media*. Boston: Allyn & Bacon.

Entwistle, V. (1995). Reporting research in medical journals and newspapers. *British Medical Journal* **310**: 920-923.

Epstein, E. J. (1974). *News From Nowhere*. New York: Vintage.

Ericson, R., P. Baranek and J. Chan. (1987). *Visualising Deviance: A Study of News Organisation*. Toronto: University of Toronto Press.

Ericson, R. V. (1998). How journalists visualise fact, in *The Future of Fact*, edited by J. J. S. a. E. Katz. Thousand Oaks, CA: Sage. pp. 83-95.

Eron, L. D. (1986). The social responsibility of the scientist, in *Reporting Science: The Case of Aggression*, edited by J. H. Goldstein. Hillsdale, New Jersey: Erlbaum. pp. 11-20.

Espiner, C. (2002). Corngate: Lend me your ears. *The Press*, Christchurch, 20 July. pp. D3.

Evans, G. and J. Durant. (1995). The relationship between knowledge and attitudes in the public understanding of science in Britain. *Public Understanding of Science* **4**: 57-74.

Evans, W. A., M. Krippendorf, J. H. Yoon, P. Posluszny and S. Thomas. (1990). Science in the prestige and national tabloid presses. *Social Science Quarterly* **71**: 105-117.

Fahnestock, J. (1993). Accommodating science: The rhetorical life of scientific facts, in *The Literature of Science: Perspectives on Popular Scientific Writing*, edited by M. W. McRae. Athens, GA: University of Georgia Press. pp. 17-36.

Fico, F. (1984). A comparison of legislative sources in newspaper and wire service stories. *Newspaper Research Journal* **5**(3): 35-43.

Fitzgerald, A. (2002). The science of producing food. *Nieman Reports* **56**(3): 40-42.

Fitzpatrick, S. M. (1999). What makes science news newsworthy? *The Scientist* **13**(23): 12.

Flegel, R. C. and S. H. Chaffee. (1971). Influences of editors, readers and personal opinions on reporters. *Journalism Quarterly* **48**: 645-651.

Freimuth, V. S., R. H. Greenberg, J. DeWitt and R. M. Romano. (1984). Covering cancer: Newspapers and the public interest. *Journal of Communication* **34**: 62-73.

Frewer, L. J., C. Howard, D. Hedderley and R. Shepherd. (1999). Reactions to information about genetic engineering: Impact of source characteristics, perceived personal relevance, and persuasiveness. *Public Understanding of Science* **8**: 35-50.

Friedman, S. M. (1986). The journalist's world, in *Scientists and Journalists: Reporting Science as News*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. New York: Free Press. pp. 17-41.

Friedman, S. M., S. Dunwoody and C. L. Rogers. (1986). *Scientists and Journalists: Reporting Science as News*. New York: Free Press.

Friedman, S. M., K. Villamil, R. A. Suriano and B. P. Egolf. (1996). Alar and apples: Newspapers, risk and media responsibility. *Public Understanding of Science* **5**: 1-20.

Fuller, J. (1996). *News Values: Ideas for an Information Age*. Chicago: University of Chicago Press.

Galtung, J. and M. Ruge. (1965). The structure of foreign news: The presentation of the Congo, Cuba and Cyprus crises in four foreign newspapers. *Journal of International Peace Research* **1**: 64-90.

Gandy, O. H. (1982). *Beyond Agenda Setting: Information Subsidies and Public Policy*. Norwood, NJ: Ablex.

Gans, H. (1979). *Deciding What's News*. New York: Random House.

Gans, H. J. (1985). Are U.S. journalists dangerously liberal? *Columbia Journalism Review* (Nov-Dec): 29-33.

Gelbspan, R. (1997). Hot air, cold truth: Why do we pay attention to greenhouse skeptics? *Washington Post*, Washington D.C., May 15, 1997. pp. C1.

Gibbs, G. R. (2002). *Qualitative Data Analysis: Explorations with NVivo*. Buckingham: Open University Press.

Gieber, W. (1964). News is what newspapermen make it, in *People, Society and Mass Communications*, edited by L. A. Dexter and D. M. White. New York: Free Press.

Gitlin, T. (1980). *The Whole World is Watching*. Berkeley: University of California Press.

Glasser, T. L. and J. S. Ettema. (1989). Investigative journalism and the moral order. *Critical Studies in Mass Communication* **6**: 1-20.

Goodell, R. (1987). The role of the mass media in scientific controversy, in *Scientific Controversies*, edited by J. H. T. Engelhardt and A. L. Caplan. Cambridge: Cambridge University Press. pp. 585-597.

Gorchow, S. (1990). Preliminary reports: how journalists interpret early findings. *Sciphers* **11**(1): 1-2.

Greenberg, M. R., P. M. Sandman, D. B. Sachsman and K. L. Salomone. (1989). Network television news coverage of environmental risks. *Environment* **31**(2): 16-20, 40-43.

Gregory, J. and S. Miller. (1998). *Science in Public: Communication, Culture and Credibility*. New York: Plenum Press.

Griffin, R. J. (1999). Using systematic thinking to choose and evaluate evidence, in *Communicating Uncertainty*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum Associates. pp. 225-248.

Griffin, R. J. and S. Dunwoody. (1995). Impacts of information subsidies and community structure on local press coverage of environmental contamination. *Journalism and Mass Communication Quarterly* **72**(2): 271-284.

Hackett, R. A. (1984). Decline of a paradigm? Bias and objectivity in news media studies. *Critical Studies in Mass Communication* **1**(3): 229-259.

Hager, N. (2002). *Seeds of Distrust: The Story of a GE Cover-Up*. Nelson, New Zealand: Craig Potton Publishing.

Hager, N. and B. Burton. (1999). *Secrets and Lies: The Anatomy of an Anti-Environmental PR Campaign*. Nelson, New Zealand: Craig Potton Publishing.

Hall, S., C. Critcher, T. Jefferson, J. Clark and B. Roberts. (1978). The social production of news, in *Policing the Crisis*, edited. London: Macmillan Press. pp. 53-77.

Hallin, D. (1986a). *The 'Uncensored War': The Media and Vietnam*. New York: Oxford University Press.

Hallin, D. C. (1986b). Network news: We keep America on top of the world, in *Watching Television: A Pantheon Guide to Popular Culture*, edited by T. Gitlin. New York: Pantheon Books. pp. 9-41.

Halloran, J. D. (1998). Mass communication research: Asking the right questions, in *Mass Communication Research Methods*, edited by A. Hansen, S. Cottle, R. Negrine and C. Newbold. London: MacMillan Press. pp. 9-34.

Hansen, A. (1994). Journalistic practices and science reporting in the British press. *Public Understanding of Science* **3**: 111-134.

Hansen, A., S. Cottle, R. Negrine and C. Newbold. (1998). *Mass Communication Research Methods*. London: MacMillan Press.

Hargreaves, I. and G. Ferguson. (2000). Who's misunderstanding whom? An inquiry into the relationship between science and the media. A report produced for the Economic and Social Research Council, 12 September 2000. [online] http://www.esrc.ac.uk/esrccontent/PublicationsList/whom/whofirst.html. (Accessed on 1 June 2003).

Hartz, J. and R. Chappell. (1997). *Worlds Apart: How the Distance Between Science and Journalism Threatens America's Future*. Nashville, Tennessee: First Amendment Center.

Hemanus, P. (1976). Objectivity in news transmission. *Journal of Communication* **26**(4): 102-107.

Hewitt, J. and R. Houlberg. (1986). Local broadcast news editors and managers: a multiple station, single market study. *Journalism Quarterly* **63**: 834-839.

Hinkle, G. and W. R. Elliott. (1989). Science coverage in three newspapers and three supermarket tabloids. *Journalism Quarterly* **66**: 353-358.

Hipkins, R., W. Stockwell, R. Bolstad and R. Baker. (2002). Commonsense, trust and science: How patterns of beliefs and attitudes to science pose challenges for effective communication. Unpublished report for Ministry of Research, Science and Technology. Wellington, NZ.

Hirsch, P. (1977). Occupational, organisational and institutional models in mass media research: Toward an integrated framework, in *Strategies for Communication Research*, edited by P. M. Hirsch, P. V. Miller and F. G. Kline. Beverly Hills, CA: Sage. pp. 13-40.

Holsti, O. R. (1969). *Content Analysis for the Social Sciences*. Reading, MA: Addison-Wesley.

Hope, W. (1996). A short history of the public sphere in Aotearoa/New Zealand. *Australian Journal of Media and Culture* **10**(1): 12-32.

Hornig, S., L. Walters and J. Templin. (1991). Voices in the news: Newspaper coverage of Hurricane Hugo and the Loma Prieta earthquake. *Newspaper Research Journal* **12**(3): 32-45.

Horrocks, R. (1996). Conflicts and surprises in New Zealand television. *Australian Journal of Media and Culture* **10**(1): 50-63.

Hotz, R. L. (2002). The difficulty of finding impartial sources in science. *Nieman Reports* **56**(3): 6.

Hutchison, I. and G. Lealand. (1996). Aotearoa/New Zealand: A new mediascape. *Australian Journal of Media and Culture* **10**(1): 1-63.

Jefferson, T., P. Alderson, E. Wager and F. Davidoff. (2002). Effects of editorial peer review - a systematic review. *Journal of the American Medical Association* **287**(21): 2784-2786.

Jeffries, J. (2002). Country Report - New Zealand, The Asia-Pacific Regional Press Freedom Seminar. The Australian Press Council, 31 January 2002. [online] http://www.presscouncil.org.au/pcsite/meetings/nz.html. (Accessed on 24 March 2003).

Johnson, K. G. (1963). Dimensions of judgement of science news stories. *Journalism Quarterly* **40**: 315-322.

Johnstone, J. W. C., E. J. Slawski and W. W. Bowman. (1972). The professional values of American newsmen. *Journalism Quarterly* **36**: 522-540.

Johnstone, J. W. L., E. J. Slawski and W. W. Bowman. (1976). *The News People.* Urbana, IL: University of Illinois Press.

Kiernan, V. (2000). The Mars meteorite: A case study in controls on dissemination of science news. *Public Understanding of Science* **9**: 15-41.

Kitzinger, J. (1994). The methodology of focus groups: The importance of interaction between research participants. *Sociology of Health* **16**(1): 103-121.

Klaidman, S. (1990). How well the media report health risk. *Daedalus* **119**(4): 119-132.

Klaidman, S. (1991). *Health in the Headlines: The Stories Behind the Stories.* New York: Oxford University Press.

Klapper, J. (1960). *The Effects of Mass Communication.* Glencoe, New York: Free Press.

Kovach, B. and T. Rosenstiel. (2001). *The Elements of Journalism.* New York: Three Rivers Press.

Kreuger, R. A. (1988). *Focus Groups: A Practical Guide for Applied Research.* London: Sage.

Krippendorff, K. (1980). *Content Analysis: An Introduction to Methodology.* Beverly Hills, CA: Sage.

Lacy, S. and J. M. Bernstein. (1988). Daily newspaper content's relationship to publication cycle and circulation size. *Newspaper Research Journal* **9**: 49-58.

Lacy, S. and A. B. Sohn. (1990). Correlations of newspaper content with circulation in the suburbs: a case study. *Journalism Quarterly* **67**: 785-793.

Lambeth, E. B. (1992). *Committed Journalism: An Ethic for the Profession.* Bloomington: Indiana University Press.

Lang, K. and G. E. Lang. (1971). The unique perspective of television and its effects: A pilot study, in *The Process and Effects of Mass Communication*, edited by W. Schramm and D. Roberts. Urbana: University of Illinois Press. pp. 169-188.

Lang, K., G. E. Lang, H.-M. Kepplinger and S. Ehmig. (1993). Collective memory and political generations: A survey of German journalists. *Political Communication* **10**: 211-229.

Lasswell, H. (1948). The structure and function of communication in society, in *The Process and Effects of Mass Communication*, edited by W. Schramm and D. Roberts. Urbana, IL: University of Illinois Press. pp. 84-99.

Levy-Leblond, J.-M. (1992). About misunderstandings about misunderstandings. *Public Understanding of Science* **1**: 17-21.

Lewenstein, B. V. (1987). Was there really a popular science "boom"? *Science, Technology and Human Values* **12**(2): 29-41.

Lewin, K. (1947). Frontiers in group dynamics: Concept, method and reality in science; social equilibria and social change. *Human Relations* **1**: 5-40.

Lichtenberg, J. (1991). In defense of objectivity, in *Mass Media and Society*, edited by J. C. a. M. Gurevitch. London: Edward Arnold. pp. 216-231.

Lippmann, W. (1920). *Liberty and the News*. New York: Harcourt, Brace and Howe.

Logan, R. A. (1998). Three opportunities to work with the news media. *Arthritis Care and Research* **11**(1): 53-58.

Logan, R. A., L. Fears and N. F. Wilson. (1997). *Social Responsibility in Science News: Four Case Studies*. Washington D.C.: The Media Institute.

Logan, R. A., P. Zengjun and N. F. Wilson. (2000a). Prevailing impressions in science and medical news: A content analysis of *The Washington Post* and the *Los Angeles Times*. *Science Communication* **22**(1): 27-45.

Logan, R. A., P. Zengjun and N. F. Wilson. (2000b). Science and medical coverage in the *Los Angeles Times* and *The Washington Post*: A six year perspective. *Science Communication* **22**(1): 5-26.

Longino, H. (1990). *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry*. Princeton, NJ: Princeton University Press.

Lordan, E. J. (1993). Do methodological details help readers evaluate statistics-based stories? *Newspaper Research Journal* **14**: 13-19.

Maharey, S. (1992). Politicians, the news media and democracy, in *Whose News?*, edited by M. Comrie and J. McGregor. Palmerston North: Dunmore Press. pp. 90-100.

Masterton, M. (1998). What makes news news?, in *Comparative Journalism Studies*, edited. Geelong: Deakin University Press.

Mazur, A. (1981). Media coverage and public opinion on scientific controversies. *Journal of Communication* **31**: 106-115.

Mazur, A. (1984). Media influences on public attitudes toward nuclear power, in *Public Reactions to Nuclear Power*, edited by W. R. Freudenburg and E. A. Rosa. Boulder, Colorado: Westview.

Mazur, A. and J. Lee. (1993). Sounding the global alarm: Environmental issues in the U.S. national news. *Social Studies of Science* **23**: 681-720.

McCall, R. B. (1988). Science and the press: Like oil and water? *American Psychologist* **43**: 87-94.

McChesney, R. (2001). Global media, neoliberalism and imperialism. *Monthly Review* **52**(10): 1-19.

McComas, K. and J. Shanahan. (1999). Telling stories about global climate change: Measuring the impact of narratives on issue cycles. *Communication Research* **26**(1): 30-57.

McCombs, M. E. and D. L. Shaw. (1993). The evolution of agenda-setting research: Twenty-five years in the marketplace of ideas. *Journal of Communication* **43**(2): 58-67.

McGregor, J. (2002). Terrorism, war, lions and sex symbols: Restating news values, in *What's News? Reclaiming Journalism in New Zealand*, edited by J. McGregor and M. Comrie. Palmerston North: Dunmore Press. pp. 111-125.

McGregor, J. and M. Comrie. (1995). Balance and Fairness in Broadcasting News (1985-1994). Unpublished report for Broadcasting Standards Authority and New Zealand on Air. Palmerston North.

McGregor, J. and M. Comrie. (2002). *What's News? Reclaiming Journalism in New Zealand.* Palmerston North: Dunmore Press.

McQuail, D. (1992). *Media Performance: Mass Communication and the Public Interest.* London: Sage Publishing.

McQuail, D. (1994). *Mass Communication Theory: An Introduction.* London: Sage Publications.

Meadows, A. J. (1986). The growth of science popularization: A historical sketch. *Impact of Science on Society* **144**: 341-346.

Meadows, A. J. and M. M. Hancock-Beaulieu. (1991). The selection of scientific information by the mass media. *Arbor* **140**: 75-91.

Metcalfe, J. and T. Gascoigne. (1995). Science journalism in Australia. *Public Understanding of Science* **4**: 411-428.

Millar, R. and B. Wynne. (1988). Public understanding of science: From contents to processes. *International Journal of Science Education* **10**: 388-398.

Miller, D. (1999). Mediating science: Promotional strategies, media coverage, public belief and decision making, in *Communicating Science: Contexts and Channels*, edited by E. Scanlon, E. Whitelegg and S. Yates. London: Routledge. pp. 206-226.

Miller, J. D. (1986). Reaching the attentive and interested publics for science, in *Scientists and Journalists: Reporting Science as News*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. New York: Free Press. pp. 55-70.

Miller, K. (1992). Smoking up a storm: Public relations and advertising in the construction of the cigarette problem 1953-1954. *Journalism Monographs* **136**.

Mindich, D. T. Z. (1998). *Just the Facts: How "Objectivity" Came to Define American Journalism.* New York: New York University Press.

Morrison, A. (2002). Objectivity, in *What's News? Reclaiming Journalism in New Zealand*, edited by J. McGregor and M. Comrie. Palmerston North: Dunmore Press. pp. 56-71.

Mosier, N. R. and A. Ahlgren. (1981). Credibility of precision journalism. *Journalism Quarterly* **58**: 375-380.

Napoli, P. M. (1997). A principal-agent approach to the study of media organisations: Toward a theory of the media firm. *Political Communication* **14**: 207-219.

Nelkin, D. (1995). *Selling Science: How the Press Covers Science and Technology.* New York: W.H. Freeman and Company.

New Zealand Audit Bureau of Circulations. (2003). Audit of newspaper circulations, March 2003. [online] http://www.abc.org.nz/audit/press.html?org=npa. (Accessed on 1 July 2003).

Newspaper Publishers' Association. (2002). Information about Newspapers 2002/03. [online] http://www.npa.co.nz/cm-npa-publications.php. (Accessed on 1 July 2003).

Norris, P. (1997). Balance and fairness in broadcasting news (1985-1994): A response from TVNZ. *New Zealand Journalism Review* **5**: 29-31.

Norris, P. (2002). News media ownership in New Zealand, in *What's News? Reclaiming Journalism in New Zealand*, edited by J. McGregor and M. Comrie. Palmerston North: Dunmore Press. pp. 33-55.

Norris, P. and B. Pauling. (1999). Local Content and Diversity: Television in Ten Countries. Unpublished report for New Zealand on Air.

NZ On Air. (2002). Local New Zealand Television Content 2002. March 2003. [online] http://www.nzonair.govt.nz/media/policyandresearch/policypdfs/Local%20Content.pdf. (Accessed on 10 June 2003).

O'Hare, N. (2003). Healthy disrespect. *New Zealand Listener* **189** (3293) (21 June 2003): 38.

Paletz, D. L. and R. M. Entman. (1981). *Media, Power, Politics.* New York: Free Press.

Parsons, P., J. Finnegan, Jr and W. Benham. (1988). Editors and their roles, in *Press Concentration and Monopoly: New Perspectives on Newspaper Ownership and Operation*, edited by R. Picard, J. Winter, M. McCombs and S. Lacy. Norwood, NJ: Ablex. pp. 91-104.

Paulos, J. A. (1995). *A Mathematician Reads the Newspaper.* New York: Basic Books.

Paulson, A. (2003). Beyond Jayson: It's little errors that hurt media. The Christian Science Monitor, 16 May. [online] http://www.csmonitor.com/2003/0516/p01s01-usgn.htm. (Accessed on 20 June 2003).

Peiser, W. (2000). Setting the journalist agenda: Influences from journalists' individual characteristics and from media factors. *Journalism and Mass Communication Quarterly* **77**(2): 243-257.

Pellechia, M. G. (1997). Trends in science coverage: A content analysis of three U.S. newspapers. *Public Understanding of Science* **6**: 49-68.

Perlman, D. (1974). Science and the mass media. *Daedalus* **103**: 207-222.

Peterson, R. A., G. Albaum, G. Kozmetsky and I. C. M. Cunningham. (1984). Attitudes of newspaper business editors and general public toward capitalism. *Journalism Quarterly* **61**: 56-65.

Pfund, N. and L. Hofstadter. (1981). Biomedical innovation and the press. *Journal of Communication* **31**(2): 138-154.

Phillips, E. B. (1977). Approaches to objectivity: Journalistic versus social science perspectives, in *Strategies for Communication Research*, edited by P. M. Hirsch, P. V. Miller and F. G. Kline. Beverley Hills, CA: Sage. pp. 63-77.

Powell, R. A. and H. M. Single. (1996). Focus groups. *International Journal of Quality in Health Care* **8**(5): 499-504.

Press body rejects complaint. (2002). *The Press*, Christchurch, NZ, February 20. pp. 26.

Price, S. (2003). Proceed with Caution. *Metro* (February): 62-70.

Priest, S. H. (1994). Structuring public debate on biotechnology: Media frames and public response. *Science Communication* **16**(2): 166-179.

Priest, S. H. (1999). Popular beliefs, media and biotechnology, in *Communicating Uncertainty: Media Coverage of New and Controversial Science*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum Associates. pp. 95-112.

Priest, S. H. (2001). Misplaced faith: Communication variables as predictors of encouragement for biotechnology development. *Science Communication* **23**(2): 97-110.

Priest, S. H. and A. W. Gillespie. (2000). Seeds of discontent: Expert opinion, mass media messages and the public image of agricultural biotechnology. *Science and Engineering Ethics* **6**: 529-539.

Protess, D. L., J. Doppelt, J. Ettema, M. Gordon and F. Cook. (1991). *The Journalism of Outrage: Investigative Reporting and Agenda Building in America*. New York: Guilford Press.

Pulford, D. L. (1976). Follow-up study of science news accuracy. *Journalism Quarterly* **53**: 119-121.

Qian, G. and D. Alvermann. (1995). Role of epistemological beliefs and learned helplessness in secondary school students' learning science concepts from text. *Journal of Educational Psychology* **87**: 282-292.

Reed, R. (2001). (Un-)Professional discourse? Journalists' and scientists' stories about science in the media. *Journalism* **2**(3): 279-298.

Reese, S. D. (1991). Setting the media's agenda: A power balance perspective. *Communication Yearbook* **14**: 309-340.

Reese, S. D. and J. Ballinger. (2001). The roots of a sociology of news: Remembering Mr. Gates and social control in the newsroom. *Journalism and Mass Communication Quarterly* **78**(4): 641-658.

Robinson, J. P., H. Sahin and D. K. Davis. (1982). Television journalists and their audiences, in *Individuals in Mass Media Organisations: Creativity and Constraint*, edited by J. Ettema and C. Whitney. Beverly Hills, CA: Sage. pp. 163-178.

Rogers, C. L. (1986). The practitioner in the middle, in *Scientists and Journalists: Reporting Science as News*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. New York: Free Press. pp. 42-54.

Rogers, C. L. (1999). The importance of understanding audiences, in *Communicating Uncertainty*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum Associates. pp. 179-200.

Rogers, E. M. and J. W. Dearing. (1988). Agenda-setting research: where has it been, where is it going?, in *Communication Yearbook 11*, edited by J. Anderson. Newbury Park, CA: Sage. pp. 555-593.

Rosen, J. (1993). Beyond objectivity. *Nieman Reports* **47**(4): 48-53.

Roshco, B. (1975). *Newsmaking*. Chicago: University of Chicago Press.

Rowan, K. E. (1989). Moving beyond the *what* to the *why*: Differences in professional and popular science writing. *Journal of Technical Writing and Communication* **19**: 165-179.

Rowan, K. E. (1999). Effective explanation of uncertain and complex science, in *Communicating Uncertainty: Media Coverage of New and Controversial*

*Science*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum Associates. pp. 201-223.

Rubin, D. M. and V. Hendy. (1977). Swine influenza and the news media. *Annals of Internal Medicine* **87**: 772-773.

Rukavina, I. and M. Daneman. (1996). Integration and its effect on acquiring knowledge about competing scientific theories from text. *Journal of Educational Psychology* **88**: 272-287.

Ryder, J. (2001). Identifying science understanding for functional scientific literacy: Implications for school science education. Paper presented at American Educational Research Association Annual Meeting, Seattle, WA, 10-14 April.

Saari, M.-A., C. Gibson and A. Osler. (1998). Endangered species: science writers in the Canadian daily press. *Public Understanding of Science* **7**: 61-81.

Sachsman, D. (1976). Public relations influence on coverage of the environment in San Francisco area. *Journalism Quarterly* **53**: 54-60.

Sandman, P. M. and M. Paden. (1979). At Three Mile Island. *Columbia Journalism Review* **18**: 43-58.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology* **82**: 498-504.

Schudson, M. (1978). *Discovering the News*. New York: Basic Books.

Schudson, M. (1999). What public journalism knows about journalism but doesn't know about "public", in *The Idea of Public Journalism*, edited by T. L. Glasser. New York: Guilford Press. pp. 118-133.

Schudson, M. (2001). The objectivity norm in American journalism. *Journalism* **2**(2): 149-170.

Shamos, M. H. (1995). *The Myth of Scientific Literacy.* New Brunswick, New Jersey: Rutgers University Press.

Shaw, D. L. (1967). News bias and the telegraph: A study of historical change. *Journalism Quarterly* **44**: 3-12.

Shaw, D. L. (1968). The nature of campaign news in the Wisconsin press 1852-1916. *Journalism Quarterly* **45**: 326-329.

Shepherd, R. G. (1979). Science news of controversy: The case of marijuana. *Journalism Monographs* **62**.

Shepherd, R. G. (1981). Selectivity of sources: Reporting the marijuana controversy. *Journal of Communication* **31**: 129-137.

Shoemaker, P. J., M. Eichholz, E. Kim and B. Wrigley. (2001). Individual and routine forces in gatekeeping. *Journalism and Mass Communication Quarterly* **78**(2): 233-246.

Shoemaker, P. J. and S. D. Reese. (1996). *Mediating the Message: Theories of Influences on Mass Media Content.* White Plains, NY: Longman.

Shortland, M. and J. Gregory. (1991). *Communicating Science: A Handbook.* Essex, England: Longman Scientific and Technical.

Sigal, L. (1973). *Reporters and Officials: The Organisation and Politics of Newsmaking.* Lexington, MA: D.C. Heath.

Singer, E. (1990). A question of accuracy: How journalists and scientists report research on hazards. *Journal of Communication* **40**: 102-116.

Singer, E., P. Endreny and M. B. Glassman. (1991). Media coverage of disasters: Effect of geographic location. *Journalism Quarterly* **68**: 48-58.

Smith, C. (1993). News sources and power elites in news coverage of the Exxon Valdez oil spill. *Journalism Quarterly* **70**: 393-403.

Smith, C. (1996). Reporters, news sources and scientific intervention: The New Madrid earthquake prediction. *Public Understanding of Science* **5**: 205-216.

Snow, C. P. (1993). *The Two Cultures*. Cambridge: Cambridge University Press.

Social Issues Research Centre, Royal Society and Royal Institution of Great Britain. (2001). Guidelines on Science and Health Communication. November 2001. [online] http://www.sirc.org/publik/revised_guidelines.shtml#check1. (Accessed on 10 June 2003).

Soloski, J. (1989). Sources and channels of local news. *Journalism Quarterly* **66**: 864-870.

Sparkman, J. (2003). Jayson Blair Continues to Rattle NY Times Reputation. Chronwatch, 26 May 2003. [online] www.chronwatch.com/content/contentDisplay.asp?aid=2846&catcode=10. (Accessed on 10 June 2003).

Spradley, J. P. (1979). *The Ethnographic Interview*. New York: Holt, Rinehart & Winston.

Stallings, R. A. (1990). Media discourse and the social construction of risk. *Social Problems* **37**(1): 80-95.

Starck, K. and J. Soloski. (1977). Effect of reporter predisposition in covering controversial stories. *Journalism Quarterly* **54**: 120-125.

Starr, D. (2002). Teaching journalism students to report on science. *Nieman Reports* **56**(3): 36-38.

Steele, J. (1990). Sound bite seeks expert. *Washington Journalism Review* (September): 28-29.

Stempel, G. (1973). Effects on performance of a cross-media monopoly. *Journalism Monographs* **29**.

Stocking, S. H. (1985). Effect of public relations efforts on media visibility of organisations. *Journalism Quarterly* **62**(2): 358-366, 450.

Stocking, S. H. (1999). How journalists deal with scientific uncertainty, in *Communicating Uncertainty: Media Coverage of New and Controversial Science*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum. pp. 23-42.

Strauss, A. and J. Corbin. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. Thousand Oaks, CA: Sage.

Streckfuss, R. (1990). Objectivity in journalism: A search and a reassessment. *Journalism Quarterly* **67**(4): 973-984.

Sullivan, D. F. (1985). Comprehensiveness of press coverage of a food irradiation proposal. *Journalism Quarterly* **62**: 832-837.

Tanaka, K., A. Broom and J. Evans. (2000). At the laboratory window: Science and society survey results. Unpublished report for University of Canterbury. Christchurch.

Tankard, J. W. and M. Ryan. (1974). News source perceptions of accuracy of science coverage. *Journalism Quarterly* **51**: 219-225.

Taylor, C. E., J.-S. Lee and W. R. Davie. (2000). Local press coverage of environmental conflict. *Journalism and Mass Communication Quarterly* **77**(1): 175-192.

The PressWise Trust. (2002). Codes of Conduct. 1 July 2002. [online] www.presswise.org.uk/Accuracy.htm. (Accessed on 1 September 2002).

Thomas, G. and J. Durant. (1987). Why should we promote the public understanding of science? *Scientific Literary Papers* **1**: 1-14.

Tichenor, P. J., G. A. Donohue and C. N. Olien. (1980). *Community Conflict and the Press*. Newbury Park, California: Sage.

Tichenor, P. J., C. N. Olien, A. Harrison and G. Donahue. (1970). Mass communication systems and communication accuracy in science news reporting. *Journalism Quarterly* **47**: 673-683.

Tidey, J. (2002). Well-informed sources, in *What's News? Reclaiming Journalism in New Zealand*, edited by J. McGregor and M. Comrie. Palmerston North: Dunmore Press. pp. 72-80.

Treise, D. and M. F. Weigold. (2002). Advancing science communication. *Science Communication* **23**(3): 310-322.

Tuchman, G. (1972). Objectivity as strategic ritual: An examination of newsmen's notions of objectivity. *American Journal of Sociology* **77**: 660-679.

Tuchman, G. (1978). *Making News: A Study in the Construction of Reality*. New York: The Free Press.

Tully, J. and N. Elsaka. (2002). Ethical codes and credibility: The challenge to industry, in *What's News? Reclaiming Journalism in New Zealand*, edited by J. McGregor and M. Comrie. Palmerston North, New Zealand: Dunmore Press. pp. 142-157.

Tunstall, J. (1991). A media industry perspective, in *Communication Yearbook 14*, edited by J. A. Anderson. Beverly Hills, CA: Sage. pp. 163-186.

TVNZ. (2001). Annual Report. March 2002. [online] http://images.tvnz.co.nz/tvnz/pdf/tvnz_annual_report_2001.pdf. (Accessed on 1 February 2003).

Underwood, D. (1993). *When MBAs Rule the Newsroom: How the Marketers and Managers are Reshaping Today's Media*. New York: Columbia University Press.

Utts, J. M. (1996). *Seeing Through Statistics*. Belmont, CA: Duxbury/Wadsworth.

van Rooyen, C. (2002). Science and technology coverage in the South African press. Paper presented at Public Communication of Science and Technology 7 Conference, Capetown, South Africa, 5-7 December 2002.

van Trigt, A. M., L. T. W. de Jong-van den Berg, F. M. Haaijer-Ruskamp, J. Willems and T. F. J. Tromp. (1994). Medical journalists and expert sources on medicines. *Public Understanding of Science* **3**: 309-321.

Ward, J. (1992). Television, in *When Science Meets the Public*, edited by B. V. Lewenstein. Washington D.C.: American Association for the Advancement of Science. pp. 103-106.

Wartenberg, D. and M. Greenberg. (1992). Epidemiology, the press and the EMF controversy. *Public Understanding of Science* **1**: 383-394.

Weaver, D. H. (1998). *The Global Journalist: News People Around the World.* Cresskill, NJ: Hampton Press.

Weaver, D. H. and G. C. Wilhoit. (1991). *The American Journalist: A Portrait of U.S. News People and their Work.* Bloomington: Indiana University Press.

Weaver, D. H. and G. C. Wilhoit. (1996). *The American Journalist in the 1990s: U.S. News People at the End of an Era.* Mahwah, N.J.: Lawrence Erlbaum.

Weigold, M. (2001). Communicating science: A review of the literature. *Science Communication* **23**(2): 164-193.

Weiss, C. H. and E. Singer. (1988). *Reporting of Social Science in the National Media.* New York: Russell Sage Foundation.

Westerstahl, J. (1983). Objective news reporting: General premises. *Communication Research* **10**(3): 403-424.

Westley, B. H. and M. MacLean. (1957). A conceptual model for communication research. *Journalism Quarterly* **34**: 32-35.

White, D. M. (1950). The gatekeeper: A case study in the selection of news. *Journalism Quarterly* **27**: 383-396.

Whitney, D. C. and L. Becker. (1982). Keeping the gates for gatekeepers: The effects of wire news. *Journalism Quarterly* **59**: 60-65.

Wilkie, T. (1996). Sources in science: Who can we trust? *Lancet* **347**: 1308-1311.

Wilkins, L. (1993). Between facts and values: Print media coverage of the greenhouse effect, 1987-1990. *Public Understanding of Science* **2**: 71-84.

Wilkins, L. and P. Patterson. (1987). Risk analysis and the construction of news. *Journal of Communication* **37**: 80-92.

Wilkins, L. and P. Patterson. (1991). *Risky Business: Communicating Issues of Science, Risk and Public Policy*. New York: Greenwood Press.

Williams, R. (1977). *Marxism and Literature*. New York: Oxford University Press.

Willis, J. (1991). *The Shadow World: Lines Between the News Media and Reality*. New York: Praeger.

Wilson, K. M. (2000). Drought, debate and uncertainty: Measuring reporters' knowledge and ignorance about climate change. *Public Understanding of Science* **9**: 1-13.

Wilson, K. M. (2002). Forecasting the future: How television weathercasters' attitudes and beliefs about climate change affect their cognitive knowledge on the science. *Science Communication* **24**(2): 246-268.

Wynne, B. (1999). Knowledge in context, in *Communicating Science: Contexts and Channels*, edited by E. Scanlon, E. Whitelegg and S. Yates. London: Routledge. pp. 4-13.

Zanker, R. (1996). Radio in New Zealand in an age of media plenty. *Australian Journal of Media and Culture* **10**(1): 33-49.

Zehr, S. C. (1999). Scientists' representations of uncertainty, in *Communicating Uncertainty*, edited by S. M. Friedman, S. Dunwoody and C. L. Rogers. London: Lawrence Erlbaum. pp. 3-22.

Ziman, J. (1992). Not knowing, needing to know, and wanting to know, in *When Science Meets the Public*, edited by B. V. Lewenstein. Washington, D.C.: American Association for the Advancement of Science. pp. 13-20.

# APPENDIX 1:

# SURVEY

---

**Survey on science coverage in the New Zealand mass media**

This survey focuses on science news, which we define broadly as including research on the physical, biological and chemical sciences, computers and technology, the environment, medicine and health, and the social sciences. The survey has five short sections that focus on: 1) science reporting in New Zealand, 2) sources for science stories, 3) handling scientific uncertainty, 4) scientific controversies, and 5) your background in science journalism.

## I. New Zealand science journalism

We would like to begin by asking you a few questions about how you view science coverage in the New Zealand media (including articles generated overseas as well as within New Zealand) and how this coverage could be improved.

1. First, we would like to know how you rate the quality of current science news in New Zealand's mass media. (Please give us your general impression of the **overall** quality of science coverage in the following media by circling one option for **EACH** source).

| | | | | | |
|---|---|---|---|---|---|
| Metropolitan daily newspapers......... | **Excellent** | **Good** | **Fair** | **Poor** | **Don't know** |
| Provincial daily newspapers ............ | **Excellent** | **Good** | **Fair** | **Poor** | **Don't know** |
| TVNZ............................................... | **Excellent** | **Good** | **Fair** | **Poor** | **Don't know** |
| TV3.................................................. | **Excellent** | **Good** | **Fair** | **Poor** | **Don't know** |
| Radio New Zealand........................... | **Excellent** | **Good** | **Fair** | **Poor** | **Don't know** |

2. Place a tick in the left hand blank beside the **three** scientific fields that **your news organisation covers the most**. Next, place a tick in the right hand blank beside the three topics that you think **should get the most attention** from your news organisation.

| **Gets most attention** | | **Should get most attention** |
|---|---|---|
| _____ | Agriculture/ Farming/ Horticulture | _____ |
| _____ | Astronomy/ Physics | _____ |
| _____ | Chemical sciences | _____ |
| _____ | Climate and atmospheric studies | _____ |
| _____ | Computers and technology | _____ |
| _____ | Environment/ Ecology/ Conservation | _____ |
| _____ | Geology | _____ |
| _____ | Genetics/ Molecular biology | _____ |
| _____ | Medicine/ Nutrition/ Health | _____ |
| _____ | Science policy | _____ |
| _____ | Social sciences | _____ |
| _____ | Other: _________________________ | _____ |

3. How much do you think the following changes would **improve** the quality of science coverage in your news organisation? (Circle one option for **EACH** change. In addition, if you think other changes are needed to improve science coverage, please list them below under "other.")

| | | | | |
|---|---|---|---|---|
| An increase in the number of reporters responsible for science | **Lots** | **Some** | **Little** | **None** |
| An increase in the amount of time spent reporting science | **Lots** | **Some** | **Little** | **None** |
| Creating a formal science and technology round | **Lots** | **Some** | **Little** | **None** |
| An increase in editorial support for science news | **Lots** | **Some** | **Little** | **None** |
| An increase in scientific training for journalists | **Lots** | **Some** | **Little** | **None** |
| A better system for delivering news from scientists to the media | **Lots** | **Some** | **Little** | **None** |
| An increase in advertising from the science sector | **Lots** | **Some** | **Little** | **None** |
| An increase in communication training for scientists | **Lots** | **Some** | **Little** | **None** |

Other (Please describe): ____________________

____________________

4. Do you think that the quantity or the quality of science coverage is a problem in the New Zealand mass media? In other words, should news organisations cover more science stories and/ or should they focus on covering science stories better? (Circle the number beside the **one** statement that you most agree with).

**1** Quantity is the biggest problem.
**2** Quality is the biggest problem.
**3** Both quantity and quality are equally important problems.
**4** Neither quantity nor quality is an important problem.

## II. Science sources

The next questions ask about how you get information for your own science stories. We are interested in what types of sources you use and how you verify their information.

5. How often do the following people initiate your science stories? (Circle the estimated percentage of your science stories that are generated by **EACH** source).

| | | | | | |
|---|---|---|---|---|---|
| Public relations (including information/ communication officers/ journalists) | **0%** | **1-25%** | **26-50%** | **51-75%** | **76-100%** |
| Scientist | **0%** | **1-25%** | **26-50%** | **51-75%** | **76-100%** |
| Editor | **0%** | **1-25%** | **26-50%** | **51-75%** | **76-100%** |
| Self-initiated | **0%** | **1-25%** | **26-50%** | **51-75%** | **76-100%** |
| Other | **0%** | **1-25%** | **26-50%** | **51-75%** | **76-100%** |

(Please describe): ____________________

6. In writing a science story, **on average** how many scientists would you try to contact for information? (Circle the number beside your answer).

   **0** None
   **1** One
   **2** Two
   **3** Three
   **4** Four
   **5** More than four

7. When a scientist gives you a statement, how often do you do the following things? (Circle your answer beside **EACH** statement).

| | | | | |
|---|---|---|---|---|
| Check with the source to be sure you have represented their views accurately | **Always** | **Usually** | **Rarely** | **Never** |
| Look for another source to provide a different perspective | **Always** | **Usually** | **Rarely** | **Never** |
| Check with a scientist to test the reliability of the story | **Always** | **Usually** | **Rarely** | **Never** |
| Check the credentials of the source | **Always** | **Usually** | **Rarely** | **Never** |
| Search the internet for information | **Always** | **Usually** | **Rarely** | **Never** |
| Search for other information on the topic through interviews or research | **Always** | **Usually** | **Rarely** | **Never** |

**III. Scientific uncertainty**

The following questions focus on the ways that you report on the uncertainty of scientific claims. Some people propose a "weight of evidence" approach whereby the reporter conducts interviews and/ or research to evaluate claims and suggest which are supported by adequate scientific data. Others, however, say that journalists should simply report what they are told in order to appear neutral and fair. We are interested in how appropriate you feel it is for reporters to evaluate and report the limitations or objections to a claim.

8. In principle, do you think the weight-of-evidence approach is a good one for science journalists to take? (Circle the number beside your answer).

   **1** Yes
   **2** No
   **3** Don't know

9. Suppose you were asked to cover this story: a scientist claims she has made an important discovery in treating a human disease, but another scientist disagrees that the discovery will be useful. Which of the following would you have the responsibility to do? (Circle **EACH** activity for which you would feel responsible).

   **1** Interview both scientists and present their claims with equal weight.

   **2** Find one or more other experts in the field to evaluate the claims.

   **3** Find out which claim the majority of scientists in the field would support.

   **4** Find out how many people were involved in the study and how long it ran.

   **5** Find out what previous research on the disease has been done.

   **6** Find out what problems or limitations the treatment might have.

   **7** Find out how much more testing would be needed before the new treatment might be available.

10. It can be difficult to acquire the information you need to determine how well-established a scientific claim is. Which of the following factors do you think makes it **difficult** for you to use the weight of evidence approach and report the background, methodology and limitations of scientific claims? (Circle the number beside **EACH** of the factors that you think might restrict your ability to use the weight-of-evidence approach).

    1 Time restrictions
    2 Space restrictions
    3 Limited understanding of scientific topics
    4 Limited knowledge of where to go to find scientific information
    5 Limited access to scientific information
    6 Fear of losing access to a source that might be useful in the future
    7 Other (Please specify): ____________________________________

11. Suppose that a journalist, who is writing a feature science article, has researched the topic carefully and although she has no scientific credentials, she has decided that there is not enough evidence to support a claim made by some scientists. Is it appropriate for her to include in her article that the weight of evidence does not support the claim? (Circle the number beside your answer).

    1 Yes, she should give all of the evidence and explain why the claim does not stand up.

    2 No, it is not appropriate for her to evaluate the evidence. She should leave that to the experts and only report the scientists' claims.

12. When is it appropriate for reporters to present their own evaluations of scientific evidence? (Circle the number beside **EACH** case where you believe it is appropriate for a journalist to provide evaluations under those conditions).

    1 If the information is complex and the audience is unlikely to have prior knowledge of the subject.

    2 If the information is controversial.

    3 If the material has not been peer reviewed.

    4 If the researchers have potential vested interests that may bias their evidence.

    5 If the story is a human interest story.

    6 If the story is an investigative piece.

    7 If the story is advocacy journalism.

    8 If the journalist has adequate and appropriate scientific knowledge.

    9 In any story, provided adequate research is conducted to back the evaluations up.

## IV. Scientific controversies

Now we turn to the related topic of how journalists cover scientific controversies. Please circle the number beside your answer to each question.

13. If a scientist or someone representing that scientist approaches you with a story that you believe is controversial, do you think that person would be offended or angry if you sought opposing viewpoints from other scientists?

    1 Yes
    2 No
    3 It depends
    4 Don't know

14. If the scientist was angry, would you seek out opposing viewpoints anyway?

    1 Yes
    2 No
    3 It depends
    4 Don't know

15. Should science stories give proportional coverage to claims so that a claim that is supported by many scientists is given more weight, time or space than a view that is supported by one or a few scientists?

    1 Yes
    2 No
    3 It depends
    4 Don't know

16. In reporting about a scientific claim that is controversial, journalistic conventions would suggest that the reporter should balance the story with other relevant perspectives. Should the journalist also provide details about which claim is supported by the weight of evidence?

    1 Always
    2 Usually
    3 Rarely
    4 Never
    5 Don't know

17. If a scientific claim is generally agreed upon by the scientific community and is contested by only one or a few scientists, should journalists include a statement from those opposing scientists in a news story?

    1 Yes
    2 No
    3 It depends
    4 Don't know

18. Maverick science is science that is unorthodox and believed to be credible by only one or a few scientists. What percentage of the science stories you write focuses on maverick science?

    1 0%
    2 1-25%
    3 26-50%
    4 51-75%
    5 76-100%

19. If a scientist makes a claim that most scientists reject (i.e. maverick science) but that would attract readers, how would you be most likely to report the story? (Circle the number beside the **ONE** method that you would be most likely to use).

    1 Not report the story since the science is not credible.
    2 Report the story but discredit the claim using statements from other scientists.
    3 Report the story as an unresolved scientific controversy with claims from scientists on both sides.
    4 Report the claim as a discovery that will interest readers but include a brief qualifying statement by an opposed scientist.
    5 Report the claim unqualified and back it up with evidence from the scientist making the claim.

V. Background information

Finally, we would like to ask you a few questions about your own experience as a science journalist in New Zealand. Circle the number beside your answer to each question.

20. How would you rank the attitude of your news organisation toward science news?

1 Highly supportive
2 Supportive
3 Neutral
4 Unsupportive
5 Highly unsupportive
6 Don't know

21. Which round(s) do you cover science under? (Circle the number beside all that apply.)

1 Agriculture/ farming
2 Education
3 Environment
4 Health/ medicine
5 Technology/ computers
6 Other (Please specify): ______________________
7 The round system is not used at my news organisation.

22. If the round system is used at your organisation, are the rounds that include science regularly rotated among staff?

1 Yes
2 No

23. How many hours **per month** do you usually spend covering science stories?

1 Less than 10 hours
2 10 - 20 hours
3 21 - 40 hours
4 41 - 60 hours
5 More than 60 hours

24. How many science stories would you typically produce in a month?

1 Fewer than 5 stories
2 5 – 10 stories
3 11 - 20 stories
4 More than 20 stories

25. Compared to the amount of time you currently spend reporting science, ideally how much time would you like to spend covering science stories in the future?

1 No time
2 Less time than I now spend
3 Same amount of time as I now spend
4 More time than I now spend
5 All of my time

26. How long have you been reporting science news?

    1 Less than 1 year
    2 1 - 3 years
    3 3 - 5 years
    4 5 - 10 years
    5 More than 10 years

27. How long have you been employed as a journalist?

    1 Less than 1 year
    2 1 - 3 years
    3 3 - 5 years
    4 5 - 10 years
    5 More than 10 years

28. What is the highest level of schooling at which you studied science?

    1 Secondary school
    2 Tertiary science courses
    3 Undergraduate University degree in science
    4 Postgraduate degree in science

29. Do you have any further comments on any of the topics covered in this survey or on the survey itself that you would like us to consider?

**Thank you very much for taking time to complete this survey**! If you like to receive the results of this study, please write your name and address on the **return envelope**.

Please place this survey in the attached stamped self-addressed envelope and mail to:
**Laura Sessions**
**Journalism Department**
**University of Canterbury**
**Private Bag 4800**

**Christchurch**

# APPENDIX 2:

# CONTENT ANALYSIS CODING SCHEDULE

---

## I. Identifier categories

1. I.D. Number (day/month/year/id letter): ________________

2. Source

   1........*Ashburton Guardian*
   2........*Bay of Plenty Times*
   3........*The Daily News*
   4........*Daily Post*
   5........*The Dominion*
   6........*The Evening Post*
   7........*Evening Standard*
   8........*The Gisborne Herald*
   9........*The Greymouth Evening Star*
   10......*Hawke's Bay Today*
   11......*The Marlborough Express*
   12......*The Nelson Mail*
   13......*The New Zealand Herald*
   14......*The Northern Advocate*
   15......*The Oamaru Mail*
   16......*Otago Daily Times*
   17......*The Press*
   18......*The Southland Times*
   19......*Sunday News*
   20......*Sunday Star Times*
   21......*The Timaru Herald*
   22......*Waikato Times*
   23......*Wanganui Chronicle*
   24......*West Coast Times*
   25......*The Westport News*
   26 ..... TV1 Breakfast
   27 ..... TV1 Good Morning
   28 ..... BBC News
   29 ..... TV1 Document NZ
   30 ..... TV1 Reel Life
   31 ..... TV1 60 Minutes
   32 ..... TV1 Assignment
   33 ..... TV1 6pm News
   34 ..... TV1 Tonight
   35 ..... TV3 6pm News
   36 ..... TV3 Nightline
   37 ..... TV3 Inside New Zealand
   38 ..... TV3 Dateline
   39 ..... TV3 20/20
   40 ..... TV3 Friday Files
   41 ..... RNZ Morning Report
   42 ..... RNZ Midday Report
   43 ..... RNZ Checkpoint
   44 ..... RNZ Eureka!
   45 ..... RNZ Insight
   46 ..... RNZ Spectrum
   47 ..... RNZ One Planet
   48 ..... RNZ Country Life
   49 ..... RNZ Discovery

3. Headline:____________________________________________________________

________________________________________________________________________

4. Story I.D.: ________________________________________________

5. Is the story a lead story or does it appear on the front page?

   1 yes

   2 no

6. What type of news is the main focus of the story?

   1 International (involves countries other than New Zealand or applies to people generally)

   2 National (New Zealand is focus of story)

   3 Local (a region or city/town in New Zealand is the focus)

7. Where is the article's author from (print only)?

   1 NZPA

   2 Staff reporter: ________________

   3 Staff reporter and NZPA: ___________________

   4 International source (AAP, Reuters, AFP, PA, AP, KRT, Times, Observer, etc)

   5 Staff reporter and international source: ______________________

8. Length (number of sentences or minutes): ____________________

9. Type of story

   1 news story

   2 feature/ news review

   3 documentary

   4 other: __________________________

10. Main topic(s) covered:

   1 agriculture/ farming

   2 astronomy

   3 biology

   4 chemical sciences

   5 climate and atmospheric studies

   6 computers

   7 environmental sciences

   8 geology

   9 genetics/ molecular biology

   10 medicine, diseases, nutrition, and health

   11 physics and nuclear energy

   12 social science

   13 technology

   14 other: __________________

11. Does the article focus on:

    1 a discovery or breakthrough

    2 development of a product or technique

    3 scientific disagreement or controversy

    4 scientist(s)

    5 other research findings

    6 future research

    7 other: ____________________

12. Does the article contain the following words? (Circle number beside each word that is present).

    1 ground breaking

    2 breakthrough

    3 wonder drug

    4 miracle

    5 none of these

**II. Evidence for the scientific claim**

13. State the central implicit or explicit scientific hypothesis (claim) discussed in the article:

    ____________________________________________

    ____________________________________________

14. Is the claim the main focus of the article?

    1 yes

    2 no

15. Is the claim (or any part of it) made without any reference to specific scientific evidence or data?

    1 yes

    2 no

16. Is there evidence that the author has tried to independently verify the validity of the claim?

    1 yes

    2 no

17. Has the research supporting the claim been peer-reviewed?

    1 Yes

    2 No

    3 Article doesn't say

18. Does the article mention potential vested interests?

    1 Yes

    2 No

19. What 'level' of science does the story focus on?
    1 Pseudo or junk science
    2 Anecdotal evidence
    3 Frontier (emergent) science
    4 Middle-aged science
    5 Textbook science

20. Who is making the claim in the article?
    1 Scientist(s) identified as expert in the field
    2 Scientist(s) identified as expert in another field
    3 Scientist(s) whose expertise/ credentials are not given
    4 Non-scientist

21. How many independent sources comment on the scientific claim (count a research group as a single source):
    a. Scientists or research groups with credentials relevant to the science at hand
       Critical: __________ Supportive: __________
    b. Scientists or research groups with credentials in other fields or not specified
       Critical: __________ Supportive: __________
    c. Scientists or research groups whose credentials are not specified
       Critical: __________ Supportive: __________
    d. Non-scientist sources
       Critical: __________ Supportive: __________

22. Count the number of sentences that are **supportive** of (agrees with, lends credence to, assumes the legitimacy of, or promotes) the hypothesis focused on in article: __________

23. How many of these supportive sentences discuss scientific data or evidence? __________

24. How many supportive sentences use anecdotes? __________

25. Count the number of sentences **critical** or doubting (finds fault or portrays in a negative or doubting way or discusses limitations) of the hypothesis focused on in article: __________

26. How many of these critical sentences discuss scientific data or evidence? __________

27. How many critical sentences use anecdotes? __________

**III. Controversy, balance and weight of evidence**

28. Is the hypothesis identified as one that is controversial within the scientific community?

    1 yes

    2 no

29. Are there obvious different perspectives or scientific controversy that is ignored in the article?

    1 yes

    2 no

    3 unsure

30. How many different opinions about the hypothesis are given (i.e. how many sources comment on the validity or importance of the hypothesis)?

    1 1

    2 2

    3 3

    4 4

    5 more than 4

| If the hypothesis is noted as controversial or if at least two different opinions about the claim are given, continue with questions 31-38. If not, skip to question 39. |
|---|

31. Does the story contain polarised controversy (i.e. claims directly opposing each other)?

    1 yes

    2 no

32. Does the article pit scientific experts against each other (i.e. "duelling scientists")?

    1 yes

    2 no

33. If the article discusses scientific controversy, is it portrayed as a puzzle or dilemma to be resolved through further research, or as a conflict or problem between scientists?

    1 puzzle or dilemma

    2 conflict or problem

34. Are the truth claims in the story accorded equal weight (i.e. none are preferentially treated)?

    1 yes

    2 no

35. If one claim is given more weight than the others, how is it validated over the other(s)?
    1 Given more space and/ or weight
    2 Evaluative statements that suggest it is right

36. If evaluative statements are made, what are they based on?
    1 Weight of scientific evidence
    2 Credentials of one scientist over another
    4 Non-scientific evidence (social, political, economic implications)
    5 Not backed up
    6 Other: ________________________________________

37. How many sentences mention the relative degree of scientific acceptance of the differing views or discuss the "spectrum of scientific opinion" ? __________

38. How many sentences discuss the weight of evidence (i.e. an overall evaluation of how much evidence supports or refutes the hypothesis)? ___________

**IV. Maverick science**

39. Does the article discuss maverick science or scientists?
    1 Yes
    2 No

**If 'no' then skip to question 43.**

40. If **yes**, is the maverick science:
    1 The main focus of the story
    2 Given as an alternative perspective

41. If maverick science is the main topic, how are the other claims presented?
    1 No opposing or dissenting truth claims are presented
    2 Differing claims are only minor (presented but don't discredit maverick idea)
    3 Differing claims are given equal weight as maverick claims (no preferential treatment)
    4 Maverick claims are discredited by other claims

42. Does the discussion of maverick science call into question well-established scientific facts, even if controversy or uncertainty is discussed?
    1 yes
    2 no

**V. Uncertainty**

43. How many sentences provide information about prior research on the hypothesis? ___________

44. How good is the author's explanation of prior research or background on the topic?
    1 Excellent
    2 Good
    3 Fair
    4 Poor
    5 Very poor or absent
    6 The information is not appropriate or needed

45. How many sentences discuss future work or unanswered questions related to the hypothesis? ___________

46. Does the article identify what needs to be done or known before the hypothesis is established knowledge?
    1 yes
    2 no
    3 n/a (hypothesis is established knowledge)

47. How many sentences explain the methodology of the research? ___________

48. How good is the author's explanation of the methodology of the research?
    1 Excellent
    2 Good
    3 Fair
    4 Poor
    5 Very poor or absent
    6 The information is not appropriate or needed

49. Which of the following are mentioned in the article? (Circle the number beside each that is mentioned.)
    1 sample size or power
    2 duration of the study
    3 probability or statistical significance
    4 potential bias or confounding factors

50. Which of these would probably be appropriate to include in this article?
    1 Sample size
    2 Duration
    3 Probability
    4 Bias or confounding factors

51. How many sentences explain to the reader why the findings are significant? ____________

52. Is it obvious why the research findings are significant?
    1 Very clear
    2 Clear
    3 Somewhat clear
    4 Not clear
    5 Very unclear

53. How many sentences discuss the limitations or generalisability of the study? ____________

54. Overall, what level of certainty does the article present?
    1 Very certain with no qualifications
    2 Certain but with some qualifications or limitations
    3 Somewhat certain but with some unanswered questions or controversy
    4 Somewhat uncertain although one claim is deemed likely
    5 Very uncertain with no one claim supported

55. How does the article deal with uncertainty?
    1 the article probably underestimates the uncertainty of the hypothesis
    2 the article probably overestimates the uncertainty of the hypothesis
    3 the article accurately conveys the overall level of uncertainty
    4 not known

56. Which of the following types of uncertainty are identified?
    1 insufficient data
    2 contradictory data
    3 different interpretations of the data
    4 uncertainty about causality
    5 predictive uncertainty about models or extrapolations
    6 uncertainty about the quality of information
    7 no uncertainty identified

# APPENDIX 3:

# FOCUS GROUP ARTICLES

## Pylon Article A ("Objectivity" strategy):

**Mother fears lines pose cancer threat**

A Tawa mother fears overhead power lines near her child's school may eventually cause cancer. Transpower will upgrade the lines near Otari School, Wilton, next month - which means the lines, now used only as backup in emergencies, will be used all the time.

Catherine Iorns, whose six-year-old son attends the school, said she wanted Transpower to reconsider the plan following a British study released this week which showed possible links between power lines and the risk of childhood leukaemia.

The study examined cases of cancer patients living near power lines and found intense and prolonged exposures to the electro-magnetic fields could slightly increase the risk of leukaemia in children.

"They haven't ruled out a link. It could be like smoking, years ago nobody thought smoking was bad for you. I don't want to take the risk," said Ms Iorns.

She sent her son to the school, a 20-minute drive from her home, because it had Montessori classes, but if the upgrade went ahead she would think about moving him.

Otari School principal Michele Whiting said the school's board of trustees had discussed the issue and was waiting for feedback from parents.

Transpower spokesman Wayne Eagleson said the power lines were crucial for the supply of electricity to Wellington. "This has been an issue for 25 years or so. All our pylons and lines operate within levels approved by the National Radiation Laboratory."

Wellington pathologist Peter Bethwaite conducted a study in the early 1990s that concluded linesmen and others exposed to strong electromagnetic fields had more risk of getting brain cancer and leukaemia than the rest of the population. He wasn't surprised at the findings from the British report and said it supported previous studies that showed a "weak association" existed between cancer and powerlines.

"The results were very similar to many other studies which showed electromagnetic exposure in adults certainly does increase the risk of cancer and leukaemia."

He says power pylons represent more of a risk than a television or other appliances because the radiation levels are high and constant. The risk with houses close to power pylons is variable, with a lot depending upon building materials.

He advises people not to panic, saying childhood cancers are rare and the increase in risk from such radiation small. "This information's been known for 20 years."

However, he adds: "I personally wouldn't advise anyone with children to live within close proximity of power lines."

"The World Health Organisation advises prudent avoidance of exposure, but sending your kids to a school with high-tension powerlines running directly above it isn't really prudent avoidance."

The British report was based on nine studies, including a New Zealand one.

## Pylon Article B ("Balancing" strategy):

### Child cancer linked to pylons

CHILDREN living close to electricity pylons face a greater risk of contracting leukaemia, it has been reported in London. Epidemiologist Sir Richard Doll had warned there might also be a link between power lines and adult cancers, the Sunday Times reported.

Sir Richard, chairman of Britain's National Radiological Protection Board's advisory group on non-ionising radiation, made the discovery after months of analysis of cancer cases of people living near pylons, the report said. It would be the first time a government body had recognised the link between electricity pylons and childhood cancer.

Research has been carried out in New Zealand which also points to a link between high levels of electromagnetic radiation and cancer. Wellington pathologist Dr Peter Bethwaite conducted a study in the early 1990s with Professor Neil Pearce at the Wellington School of Medicine on occupational exposure to concern risks.

Dr Bethwaite says power station workers, linemen, appliance repairers, and welders have high levels of exposure to electromagnetic radiation and have more risk of getting brain cancer and leukaemia than the rest of the population.

But a New Zealand scientist who has done research similar to Sir Richard Doll's study said yesterday that people living close to electricity pylons need not panic. Otago University lecturer John Dockerty, whose 1998 study found no significant link between childhood cancer and electromagnetic fields caused by household appliances and power lines, said the report of Sir Richard's latest work was quite unclear.

Dr Dockerty backed the results of his Otago study. That data was fed into international studies also trying to determine links between electromagnetic fields and radiation.

"What they showed us was that for the very large majority of children in our country, (at) the field levels they were exposed to, there was no risk."

Dr Dockerty would be trying to access the full British report, and contacting people he had worked with there to find out more.

The Sunday Times quoted Professor Colin Blakemore, a member of Sir Richard's group, saying: "The evidence is that there is a slightly elevated risk of cancer near to power lines. We are going to acknowledge that evidence exists indicating an association between power lines and cancer."

Professor Blakemore said the reason might be linked to pylons emitting charged particles -- or ions -- that react with oxygen and nitrogen in the air and stick to airborne pollutants, which are breathed in. The electric charge may allow pollutants to enter human cells more easily.

Professor Denis Henshaw, of Bristol University, also discovered a possible mechanism in 1999, after carrying out tests on 2000 power lines. He found that the magnetic fields around cables attract particles linked with cancer, such as benzene and radon.

## Pylon Article C ("Weight of evidence" strategy):

**Do high-voltage power lines cause cancer?**

The high-tension furore over a recent British study into the health effects of electromagnetic fields could leave many people thinking that British epidemiologist Sir Richard Doll had proved a definite link between cancer and high-tension power lines.

In fact, his study -- based on re- examining the result of nine other studies from around the world, including New Zealand -- points to only a weak link, but one which the professor says warrants further investigation.

The careful analysis of studies from nine countries, published in the last five years, indicated that the risk of childhood leukaemia doubled from less than one in every 20,000 children a year to less than one in 10,000 for children with the highest exposure to low-frequency electromagnetic fields. Such high levels of exposure are described as rare, even for those living near high-voltage lines.

Professor Doll says the slightly increased risk could be down to chance, and there is still no evidence of a causal link between electromagnetic fields and cancer.

The study found that, among 500 cases of leukaemia in children, just two were linked to electromagnetic fields. Of these two cases, there was an 80 per cent chance the cancer was associated with high levels of electricity already around the home, and a
20 per cent chance it could be blamed on pylons.

Professor Colin Blakemore, a brain specialist at Oxford University and a member of Professor Doll's group, says: "The evidence is that there is a slightly elevated risk of cancer near power lines ... we need to do more research on it."

However, he describes the increase as "not statistically that clear".

"The elevation of risk is so small that even if it was true, the effect on observed incidence of leukaemia would be negligible."

Dr John Toy, medical director of Britain's Imperial Cancer Research Fund, says that, if anything, the findings should allay public concerns.

"Hopefully, public concern will be lessened by the finding that there is no decent evidence to support the theory that domestic electromagnetic fields cause cancer in adults."

Hundreds of studies have been conducted into the possible health effects of electromagnetic fields generated by high-voltage power lines. A possible link between overhead power lines and cancer was first made in the United States in 1979, but results in later studies have given conflicting results.

It is an inherently difficult subject to study and the results have conflicted widely. No sooner has one study dismissed a link than another comes up with one. Scientists also face the problem of building socio-economic factors into their results, with high-tension lines more often running through poorer parts of cities.

New Zealand's National Radiation Laboratory, in its information brochure on electric and magnetic fields, says that despite all the studies, it is still unclear whether electric and magnetic fields pose any risks.

"However, if there are risks, the results obtained show that they must be small."

## GM Article A ("Objectivity" strategy):

**Protesters see risk to butterflies**

THE fight against genetic engineering stepped up a gear yesterday at a Wellington hearing of an application to test modified maize, with protesters lining the streets to highlight a perceived risk to monarch butterflies.

Greenpeace and Revolt Against Genetic Engineering (RAGE) were protesting against an application by plant breeding company Pioneer NZ, a subsidiary of Pioneer Hi-Bred International, to field test genetically modified maize near its Pukekohe research facilities. The application to the Environmental Risk Management Authority, is to introduce to maize a hybrid gene hoped to give the crop a herbicide resistance leading to a natural resistance to pests. The company wants to continue trials carried out last year that were approved by the earlier ruling body, the interim assessment group.

The application has attracted heightened attention because of recent findings by Cornell University in the United States that pollen from modified corn could harm monarch butterflies when it was fed to them. Researchers found that wind-borne pollen from corn expressing the *Bacillus thuringiensis* (Bt) gene could kill monarch butterfly larvae on milkweed leaves. Bt is a natural biopesticide, being genetically-added to seeds as a built-in first attack. Caterpillars that were fed the Bt pollen in the laboratory studies died within four days, those fed normal pollen did not.

Yesterday Pioneer research associate Rex Oliver put his company's request for a nursery that, alongside European and North American breeding stations, would enable two crops a year, speeding up the company's capability of producing new hybrids for growers.

According to Mr Oliver, pollination would not involve insects, and there was little likelihood of windborne transfer to outside crops because of the distance separating them. Pollinations would be made by placing paper bags over the plants, with pollen collection and transfer by hand. No seed would remain in New Zealand at the end of the trial. These would either be destroyed or exported to France for future breeding efforts.

The hearing heard a lot of submissions opposing the application and the technology, including claims by Brightwater resident Oraina Jones that modified crops had been linked to meningitis and cancer.

RAGE opposed the application on grounds including a perceived danger of creating parasitic gene-carrying DNA molecules, which can invade cells and cause genetic damage. It sought a moratorium of at least three years until science could show conclusively that there was no threat to the food chain of humans and other life.

Federated Farmers, however, welcomed the application of gene technology for its potential benefits to New Zealand producers.

Though reserving its decision, the authority noted in an evaluation of the application that maize did not appear to be a food plant of monarch caterpillars. It also noted a need to consider the effect of insecticidal sprays now being used on beneficial insects.

## GM Article B ("Balancing" strategy):

### GM corn 'risk to butterflies'

Greenpeace and a group of United States corn growers took opposing sides last week as they reacted to a study that found pollen from genetically modified corn could be deadly to Monarch butterflies.

The environmental group said the findings underscored its campaign for further testing of genetically-modified (GM) crops to ensure they are safe for humans and the environment.

The National Corn Growers Association (NCGA) rejected the study's call for more evaluation before such crops are planted extensively, saying the "findings are nothing new".

"It puts responsibility on food companies which continue to use GM corn and say its safe," Greenpeace genetic engineering specialist Charles Margulis said.

"We have millions of acres of these crops out there without having done any studies to ensure their safety. It's an approach that puts end users and the environment at risk."

Iowa State University researchers said Monarch butterfly caterpillars were seven times more likely to die when they ate milkweed plants carrying pollen from Bt corn, that contains a pest-fighting gene, compared with conventional varieties.

Bt is short for *Bacillus thuringiensis*, a naturally occurring soil bacterium that acts as a pesticide. The gene has been spliced into millions of acres of US corn and cotton plants to repel the European corn borer, bollworms and other pests.

The researchers, John Obrycki and Laura Hansen, placed potted milkweed plants in and around Bt cornfields to stimulate naturally occurring conditions.

The study analysed the impact on larvae from two types of Bt corn developed by Novartis AG and sold under the brand names NatureGard and Attribute. Novartis has defended the safety of its Bt corn.

One year ago, Cornell scientists reported Monarch larvae died when fed relatively large amounts of Bt corn pollen in the laboratory. However, University of Illinois scientists said in June they found no ill effects on black swallowtail butterfly caterpillars who ate pollen from a variety of Bt corn developed by Pioneer Hi-Bred International, a unit of DuPont Co.

"The scientific findings are nothing new," said NCGA chairman Roger Pine. "The ecological effects are not unexpected and are in line with other studies that have been conducted."

He said the type of Bt corn used in the study was not widely planted and was known to leave a high level of pesticide in its pollen. "Bt technology is not nearly as detrimental to butterflies and other nontarget species as some alternative technologies used to control insect pests," he said.

The NCGA supports continued evaluation of all agricultural technologies but "we won't stop dead in our tracks when a single study draws faulty conclusions from unrelated scientific findings".

Greenpeace's Margulis refuted the NCGA claim that the variety of Bt corn used in the study was not widely used. Such studies were going to raise concerns among consumers and this would lead to a decline in the market for GMO products.

## GM Article C ("Weight of Evidence" strategy):

### Is GM corn a risk to wildlife?

Most genetically modified crops have been altered with genes that enable them to either resist pests or tolerate weed-killing herbicides. To date, insect resistance has been provided by a gene from the soil bacterium *Bacillus thuringiensis* (Bt), which has allowed farmers to reduce their use of toxic pesticides.

However, in 1998 a Swiss study provoked widespread worry that Bt plants can inadvertently harm certain insects. In this laboratory experiment, green lacewing caterpillars proved more likely to die after eating European corn-borer caterpillars that had fed on Bt corn instead of regular corn.

Fear erupted again a year later, when Cornell University entomologist John Losey and his colleagues reported that they had fed milkweed leaves dusted with Bt corn pollen to monarch butterfly larvae in the lab and that those larvae, too, had died.

Suddenly, all eyes turned to the organisms that eat GM plant leaves, carry modified pollen and live in the soil below the plants—organisms that play vital roles in sustaining plant populations. Another alarming study relating to monarch butterflies appeared last August.

But the lab bench is not a farm field, and many scientists question the usefulness of these early experiments. The lab insects, they note, consumed far higher doses of Bt toxin than they would outside, in the real world.

So researchers have headed into the field themselves, measuring the toxin in pollen from plots of GM corn, estimating how much of it drifts onto plants such as milkweed and, finally, determining the exposure of butterfly and moth larvae to the protein. Much of that work, done during the 2000 growing season, is slated to be reported shortly.

According to the United States Environmental Protection Agency (EPA), however, preliminary studies evaluating the two most common Bt corn plants (from Novartis and Monsanto) already indicate that monarch larvae encounter Bt corn pollen on milkweed plants—but at levels too low to be toxic.

What is toxic? The EPA estimates that the insects face no observable harm when consuming milkweed leaves laden with up to 150 corn pollen grains per square centimetre of leaf surface. Recent studies of milkweed plants in and around the cornfields of Maryland, Nebraska and Ontario report far lower levels of Bt pollen, ranging from just 6 to 78 grains of Bt corn pollen per square centimetre of milkweed leaf surface.

"The weight of evidence suggests BT corn pollen in the field does not pose a hazard to monarch larvae," concludes EPA scientist Zigfridas Vaituzis.

But the jury is still out. "There's not much evidence to weigh," notes Jane Rissler of the Union of Concerned Scientists. "This issue of non-target effects is just a black hole, and the EPA has very little good data at this point to conclude whether the monarch butterfly problem is real, particularly in the long term."

In an EPA meeting on GM crops last fall, Vaituzis acknowledged the lack of long-term data on Bt crops and insect populations. Such studies "require more time than has been available since the registration of Bt crops," Vaituzis remarked. The EPA, he added, continues to collect Bt crop data—but so far without evidence of "unreasonable adverse effects" on insects in the field.